UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	12/08/2015	9205380	976-177	7293

26909 7590 11/18/2015

Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 159 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Paul Su, Saratoga, CA;

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26909 7590 08/06/2015
Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Jennifer Valcov	(Depositor's name)
/JV/	(Signature)
2015-11-05	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	02/25/2013	Paul Su	976-177	7293

TITLE OF INVENTION: Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	11/06/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
PREGLER, SHARON	1772	585-639000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Timothy A. Hott
2 Janet Farrant
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Membrane Technology and Research, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Newark, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☒ Advance Order - # of Copies 10

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 505246 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☒ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Timothy A. Hott/ Date 2015-11-05

Typed or printed name Timothy A. Hott Registration No. 67,740

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal

Application Number:	13776362
Filing Date:	25-Feb-2013
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Filer:	Janet E. Farrant/Jennifer Valcov
Attorney Docket Number:	976-177

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
Printed Copy of Patent - No Color	8001	10	3	30
		Total in USD ($)		**510**

Electronic Acknowledgement Receipt

EFS ID:	24001045
Application Number:	13776362
International Application Number:	
Confirmation Number:	7293
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Customer Number:	26909
Filer:	Janet E. Farrant/Jennifer Valcov
Filer Authorized By:	Janet E. Farrant
Attorney Docket Number:	976-177
Receipt Date:	05-NOV-2015
Filing Date:	25-FEB-2013
Time Stamp:	16:12:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$510
RAM confirmation Number	2879
Deposit Account	505246
Authorized User	VALCOV, JENNIFER

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	177Issuefee.pdf	90717 0922568e7b15506779a3fab64686a6d083086c35	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31846 488cc78b3e6f9d74bf1e4fc851211071ef701aab	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	122563		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

26909 7590 08/06/2015

Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

EXAMINER
PREGLER, SHARON

ART UNIT	PAPER NUMBER
1772	

DATE MAILED: 08/06/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	02/25/2013	Paul Su	976-177	7293

TITLE OF INVENTION: Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	11/06/2015

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26909 7590 08/06/2015
Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	02/25/2013	Paul Su	976-177	7293

TITLE OF INVENTION: Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	11/06/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
PREGLER, SHARON	1772	585-639000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
❑ Issue Fee
❑ Publication Fee (No small entity discount permitted)
❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
❑ A check is enclosed.
❑ Payment by credit card. Form PTO-2038 is attached.
❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
❑ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	02/25/2013	Paul Su	976-177	7293

26909 7590 08/06/2015

Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

EXAMINER	
PREGLER, SHARON	

ART UNIT	PAPER NUMBER
1772	

DATE MAILED: 08/06/2015

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/776,362	SU, PAUL	
	Examiner	Art Unit	
	SHARON PREGLER	1772	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SHARON PREGLER*.

(3) *Richard Baker*.

(2) *Tim Hott*.

(4)_____.

Date of Interview: *25 June 2015*.

Type: ☐ Telephonic ☒ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *pending*.

Identification of prior art discussed: *cited*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The Applicants discussed the differences of the invention over the cited prior art. They explained that their invention comprises a membrane selective to hydrogen over C2 hydrocarbons and that the cited prior art Senetar teaches a membrane selective to C2 over hydrogen, which is opposite to the membrane of the Applicant. The Applicants describe that the benefit of using their membrane in a methanol-to-propylene process loop allows a residual stream with the appropiate pressure for recycle.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SHARON PREGLER/ Examiner, Art Unit 1772	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Notice of Allowability	Application No. 13/776,362	Applicant(s) SU, PAUL	
	Examiner SHARON PREGLER	Art Unit 1772	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Interview 6/25/15*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-9 and 18-29*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/SHARON PREGLER/
Examiner, Art Unit 1772

REASONS FOR ALLOWANCE

The following is an examiner's statement of reasons for allowance:

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

During the interview on June 25, 1015, the novelty of the invention over the prior was discussed. The Applicants have found that by using a hydrogen selective membrane to separate hydrogen and C2 hydrocarbons, a residue stream C2 hydrocarbon stream with a high pressure is obtained. The residue stream is at the appropriate pressure and can be recycled back to the reaction loop while bypassing costly compression steps. The Examiner finds the arguments on the Remarks on the bottom of page 6 to 7 persuasive. Thus, the prior art does not teach or fairly suggest a process for converting methanol to propylene to obtain an effluent, directing the effluent to a hydrogen selective membrane to obtain a low pressure hydrogen-rich stream and a high pressure C2 hydrocarbon residue recycle stream.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHARON PREGLER whose telephone number is (571)270-5051. The examiner can normally be reached on Mon - Fri 8am-4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, In Suk Bullock can be reached on (571)272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SHARON PREGLER/
Examiner, Art Unit 1772

/IN SUK BULLOCK/
Supervisory Patent Examiner, Art Unit 1772

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/776,362	SU, PAUL	
	Examiner	Art Unit	
	SHARON PREGLER	1772	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SHARON PREGLER*.

(3) *Richard Baker*.

(2) *Tim Hott*.

(4)_____.

Date of Interview: *25 June 2015*.

Type: ☐ Telephonic ☒ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *pending*.

Identification of prior art discussed: *cited*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The Applicants discussed the differences of the invention over the cited prior art. They explained that their invention comprises a membrane selective to hydrogen over C2 hydrocarbons and that the cited prior art Senetar teaches a membrane selective to C2 over hydrogen, which is opposite to the membrane of the Applicant. The Applicants describe that the benefit of using their membrane in a methanol-to-propylene process loop allows a residual stream with the appropiate pressure for recycle.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SHARON PREGLER/ Examiner, Art Unit 1772	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

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- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
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3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

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Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	**Art Unit**
	SHARON PREGLER	1772

CPC								
Symbol							**Type**	**Version**
B01D		61	/	36			F	2013-01-01
C07C		1	/	22			I	2013-01-01
B01D		53	/	22			I	2013-01-01
C07C		1	/	20			I	2013-01-01
C07C		7	/	144			I	2013-01-01
			/					
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			/					
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			/					
			/					

CPC Combination Sets									
Symbol							**Type**	**Set**	**Ranking**	**Version**
C07C		1	/	20			I	1	1	2013-01-01
C07C		11	/	06			I	1	2	2013-01-01
C07C		7	/	144			I	2	1	2013-01-01
C07C		11	/	04			I	2	2	2013-01-01

/SHARON PREGLER/ Examiner.Art Unit 1772	07/20/2015	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	21	
/IN SUK BULLOCK/ Supervisory Patent Examiner.Art Unit 1772	08/05/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2A

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	**Art Unit**
	SHARON PREGLER	1772

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
585	639	C 0 7 C 1 / 22 (2006.0)	

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
585	638	640			

/SHARON PREGLER/ Examiner.Art Unit 1772	07/20/2015	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	21	
/IN SUK BULLOCK/ Supervisory Patent Examiner.Art Unit 1772	08/05/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2A

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	**Art Unit**
	SHARON PREGLER	1772

☒ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

/SHARON PREGLER/ Examiner.Art Unit 1772	07/20/2015	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	21	
/IN SUK BULLOCK/ Supervisory Patent Examiner.Art Unit 1772	08/05/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2A

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	12	585/638,639,640,641.ccls. and (membrane or adsorp$4) and hydrogen and permeate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/07/20 12:37
L2	24617	(membrane or adsorp$4) and hydrogen and permeate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/07/20 12:38
L3	583	(membrane) and hydrogen (selectiv$4) same (c2 or ethylene or ethene or ethane)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/07/20 12:39
L4	123	(membrane) same hydrogen (selectiv$4) same (c2 or ethylene or ethene or ethane) and pressure and (oxygenate or methanol)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/07/20 12:39
L5	39	4 and "585".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/07/20 12:40
S1	1	"13776362"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:35
S2	388	methanol and (propylene or propene) and C07C1/$.cpc. and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:35
S3	2	("6544316").PN.	US-PGPUB;	WITH	ON	2014/09/23

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:36
S4	27	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same glassy polymer	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:37
S5	10	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same glassy polymer and (ethani$3 or deethani$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:40
S6	16	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same glassy polymer and (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene) same membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:43
S7	375	methanol and (propylene or propene) and C07C1/$.cpc. and membrane and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:42
S8	248	S7 and (compress$3 and quench$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:43
S9	28	S8 and (glass$3 polymer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:43
S10	453	methanol and (propylene or propene) and (C07C7/00,11,12,144.CPC. or C07C1/$.cpc.) and membrane and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:47
S11	274	S10 and (compress$3 and quench$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	WITH	ON	2014/09/29 14:47

			IBM_TDB			
S12	34	S10 and (compress$3 and quench$3) and glass$4 polymer	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:48
S13	15	S10 and (permea$4 gpu)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:49
S14	15	S10 and (permea$4 gpu) same membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:49
S15	25	S10 and ((ethylene or ethene) same hydrogen select$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:54
S16	4	S10 and ((ethylene or ethene) same hydrogen select$4 same membrane)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:54
S17	9	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 14:57
S18	5	S17 and selectiv$4 same hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:57
S19	5	S12 and selectivity same (light or hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:59
S20	357	methanol and (propylene or propene) and (C07C7/00,11,12,144.CPC. or C07C1/$.cpc.) and membrane same (separat$4 or recover$4) and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	WITH	ON	2014/09/29 15:02

			DERWENT; IBM_TDB			
S21	77	methanol and (propylene or propene) and (C07C7/00,11,12,144.CPC. or C07C1/$.cpc.) and membrane same (separat$4 or recover$4) and hydrogen selectiv$4 and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:02
S22	248	methanol and (propylene or propene) and C07C1/$.cpc. and membrane and hydrogen and (ethylene or ethene) and compress$4 and quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:04
S23	187	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same separat$4 and hydrogen and (ethylene or ethene) and compress$4 and quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:04
S24	74	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same separat$4 and hydrogen same selectiv$4 and (ethylene or ethene) and compress$4 and quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:04
S25	1	S17 and S24	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:07
S26	13701	methanol and (propylene or propene) and membrane same (separat$4 or recover$4) and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:07
S27	1352	methanol and (propylene or propene) and membrane same (separat$4 or recover$4) and hydrogen selectiv$4 and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:10
S28	58	S27 and C07C1/$.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:13
S29	2	"6264828".pn.	US-PGPUB; USPAT; USOCR;	WITH	ON	2014/09/29 15:13

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S30	8	"6141988"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:15
S31	3	"6141988" and methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:15
S32	14	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 15:16
S33	91	C07C1/00,24,22.cpc. and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S34	67	C07C1/00,24,22.cpc. and membrane same (recover or separat$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S35	9	C07C1/00,24,22.cpc. and membrane same (recover or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S36	11	C07C1/00,24,22.cpc. and membrane same (recover or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S37	141	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recover or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:19

S38	143	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recov$3 or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:24
S39	104	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recov$3 or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6) and quench$4 and compress$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:24
S40	104	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recov$3 or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6) and quench$3 and compress$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:25
S41	18	("20050150817" | "20070007175" | "20080154078" | "4257877" | "4423264" | "5026936" | "5371308" | "5523502" | "6049017" | "6090270" | "6646176" | "7128827" | "7161051" | "7431821" | "7601309" | "7728185" | "7732650" | "7741526").PN. OR ("8829259").URPN.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 15:28
S42	2	S41 and membrane	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 15:29
S43	2	S41 and membrane and hydrogen	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 15:29
S44	15	(("5082481") or ("6069288") or ("5904880") or ("5927063") or ("6121503") or ("5927063")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/09/29 15:52
S45	241	methanol and (propylene or propene) and C07C1/$.cpc. and membrane (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:05
S46	227	methanol and (propylene or propene) and C07C1/$.cpc. and membrane (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene or methane) and (membrane or separat$4 or recover) same (hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:05
S47	218	methanol and (propylene or propene) and C07C1/00,20,24,22.cpc. and membrane (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene or methane) and (membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	WITH	ON	2014/09/29 16:45

		or separat$4 or recover) same (hydrogen)	DERWENT; IBM_TDB			
S48	180	methanol and (propylene or propene) and C07C1/00,20,24,22.cpc. and membrane (membrane or separat$4 or recover) (C2 or ethylene or ethane or ethene or methane) and (membrane or separat$4 or recover) (hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:48
S49	120	S48 and 585/638,639,640,641.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:48
S50	179	methanol and (propylene or propene) and C07C1/00,20,24,22.cpc. and membrane (membrane) same (C2 or ethylene or ethane or ethene or methane) and (membrane) same (hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:50
S51	29	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 17:00
S52	27	S51 and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:01
S53	15	S51 and membrane and (glassy polymer or polyimid$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:02
S54	11	S53 and quench$3 and compress$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:03
S55	11	S54 and hydrogen	US-PGPUB;	WITH	ON	2014/09/29

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			17:05
S56	6	S55 and membrane same hydrogen same (ethene or ethylene or methane)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:06
S57	1	"7626067".pn. and hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S58	230	"5904880"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S59	3	"5904880".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S60	206	S58 and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S61	179	S58 and membrane same hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S62	179	S58 and membrane same hydrogen and methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:10
S63	384	"5019143" or "452581" or "082481"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	WITH	ON	2014/09/29 17:11

			IBM_TDB			
S64	370	"5019143" or "452581" or "5082481"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:11
S65	322	"5019143" or "5452581" or "5082481"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:11
S66	197	S65 and membrane same hydrogen and methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:11
S67	197	S65 and membrane same hydrogen and methanol and (ethene or ethane or ethylene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:12
S68	128	S67 and "585".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:12
S69	128	S68 and (propylene or propene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:12
S70	31	pregler.xa. and "585".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:15
S71	18	("20050150817" | "20070007175" | "20080154078" | "4257877" | "4423264" | "5026936" | "5371308" | "5523502" | "6049017" | "6090270" | "6646176" | "7128827" | "7161051" | "7431821" | "7601309" | "7728185" | "7732650" | "7741526").PN. OR ("8829259").URPN.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:15
S72	2413	585/639,640,641,638.ccls.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:17

S73	907	S72 and ((ethylene or ethene or ethane) (separat$4 or split$3) and (propylene or propane or propene) (separat$4 or split$3)) or (deethani$6 and depropani$6)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:18
S74	515	S73 and methanol same (propylene or propene or olefin$3)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:19
S75	151	S74 and membrane same hydrogen	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:19
S76	1	"6141988".pn. and propylene	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:53
S77	769	engler.inv.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:54
S78	1	engler.inv. and methanol same olefin and membrane same hydrogen and (membrane or separat$4 or recover$3) same (propylene or olefin$4)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:54
S79	1	engler.inv. and methanol same olefin and membrane	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:54
S80	113	engler.inv. and membrane	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:55
S81	2	engler.inv. and membrane same hydrogen and (membrane or separat$4 or recover$3) same (propylene or olefin$4)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:55
S82	4	("4499327").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/09/29 18:19
S83	29	"7135604" and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:20
S84	1	"7626067" and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:20
S85	8	S72 and membrane same hydrogen selectiv$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:24

S86	2	"5879431".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:26
S87	191	(john senetar).inv.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:27
S88	7	(john senetar).inv. and propylene and methanol and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:27
S89	34	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 19:43
S90	11	S89 and (ethylene or ethene or hydrocarbon) diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 19:43
S91	204	methanol propylene and (ethylene or ethene or hydrocarbon) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 19:44
S92	19	methanol propylene and (ethylene or ethene) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 19:44
S93	2	methanol and 585/638,640,641,642.ccls.	US-PGPUB;	WITH	ON	2014/09/29

		and (ethylene or ethene) adj3 diluent	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			20:01
S94	5	585/638,640,641,642.ccls. and (ethylene or ethene) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:01
S95	158	585/638,640,641,642.ccls. and (ethylene or ethene) diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:02
S96	110	585/638,640,641,642.ccls. and (ethylene or ethene) diluent and methanol propylene	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:02
S97	28	585/638,640,641,642.ccls. and (ethylene or ethene or olefin) adj3 diluent and methanol propylene	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:15
S98	0	7626067/pn/	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:21
S99	2	"7626067".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:21
S100	35	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$ or US-20090187056-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-	US-PGPUB; USPAT	WITH	ON	2014/09/29 20:44

		8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$).did.				
S101	4	S100 and permeance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:44
S102	3	S100 and permeance same hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:45
S103	4	S100 and permeance same gpu	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:46
S104	34	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$ or US-20090187056-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$).did.	US-PGPUB; USPAT	WITH	ON	2014/10/02 17:28
S105	7	S104 and distill$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/10/02 17:28
S106	28	S104 and distillat$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/10/02 17:28
S107	2	"5879431".pn.	US-PGPUB; USPAT;	WITH	ON	2015/03/25 14:40

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S108	35	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$ or US-20090187056-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$ or US-5879431-$).did.	US-PGPUB; USPAT	WITH	ON	2015/03/25 15:50
S109	1	S108 and chewter and (co-feed or co-fed)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 15:50
S110	35599	"95".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:29
S111	441	585/638,639.ccls. and (methanol and (propylene or propene)) and (membrane or adsorp$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:32
S112	405	585/638,639.ccls. and (methanol and (propylene or propene)) and (membrane or adsorp$4) and hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:33
S113	226	585/638,639.ccls. and (methanol and (propylene or propene)) and (membrane or adsorp$4) separat$4 and hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:33
S114	8	585/638,639.ccls. and (methanol and (propylene or propene)) and	US-PGPUB; USPAT;	WITH	ON	2015/03/25 16:33

		(membrane or adsorp$4) separat$4 and hydrogen and permeate	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S115	10	585/638,639.ccls. and (methanol and (propylene or propene)) and (membrane or adsorp$4) and hydrogen and permeate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:33
S116	10	585/638,639.ccls. and (membrane or adsorp$4) and hydrogen and permeate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:34
S117	13	585/638,639.ccls. and permeate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:34
S118	4346	(methanol and (propylene or propene)) and (membrane or adsorp$4) and hydrogen and permeate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2015/03/25 16:35

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	55	(membrane) same hydrogen (selectiv$4) same (c2 or ethylene or ethene or ethane) and pressure and (oxygenate or methanol)	USPAT; UPAD	WITH	ON	2015/07/20 12:40
L7	37	(membrane) same hydrogen (selectiv$4) same (c2 or ethylene or ethene or ethane) and pressure and (oxygenate or methanol) and recycl$4	USPAT; UPAD	WITH	ON	2015/07/20 12:41
L8	0	((membrane) same hydrogen (selectiv$4) same (c2 or ethylene or ethene or ethane) and pressure and (oxygenate or methanol) and recycl$4).clm.	USPAT; UPAD	WITH	ON	2015/07/20 12:42
L9	0	((membrane) same hydrogen (selectiv$4) same (c2 or ethylene or ethene or ethane) and (oxygenate or methanol) and recycl$4).clm.	USPAT; UPAD	WITH	ON	2015/07/20 12:42

7/20/2015 2:36:43 PM
C:\Users\spregler\Documents\EAST\Workspaces\585\Oxygenates\13776362 MTP Membrane.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	Art Unit
	SHARON PREGLER	1772

CPC- SEARCHED		
Symbol	Date	Examiner
C07C7/00,11,12,144	9/30/2014	SKP
C07C1/$	9/30/2014	SKP

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
585	638,639,640,641	9/30/2014	SKP

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search Attached	9/30/2014	SKP
East Search Attached	7/20/2015	SKP
Google Search	7/20/2015	SKP
Inventor Search	7/20/2015	SKP

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	Interference Search Attached	7/20/2015	SKP

/SHARON PREGLER/ Examiner.Art Unit 1772	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:	Paul Su	Examiner:	S. Pregler
Serial number:	13/776,362	Group Art Unit:	1772
Filed:	February 25, 2013		
For:	MEMBRANE TECHNOLOGY FOR USE IN A METHANOL-TO-PROPYLENE CONVERSION PROCESS		

July 9, 2015

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION MAILED 04/07/2015

Mail Stop Amendment
Hon. Commissioner of Patents and Trademarks
P.O. Box 1450
Alexandria, Virginia 22313-1450

Madam:

This communication is in response to the Non-Final Office Action dated April 7, 2015.

Listing of the Claims begins on page 2.

Remarks begin on page 6.

IN THE CLAIMS

1. (Original): A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream as a feed stream across the feed side;

(e) withdrawing from the permeate side a permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the feed side a residue stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the residue stream as a recycle stream back to step (a).

2. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a point of the operation where the pressure is at least 1 bar less than the feed stream pressure.

3. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a compressor located downstream of a de-ethanizer column.

4. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a compressor downstream of a quench column.

5. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a methanol-to-propylene reactor.

6. (Original): A process in accordance with Claim 1, wherein the membrane comprises a glassy polymer.

7. (Original): A process in accordance with Claim 1, wherein the membrane has a selectivity for hydrogen over ethylene of at least 10.

8. (Original): A process in accordance with Claim 1, wherein the membrane has a hydrogen permeance of at least about 500 gpu.

9. (Original): A process in accordance with Claim 1, wherein the membrane is also selective for carbon oxides over C_2 hydrocarbons.

10.-17. (Cancelled).

18. (Original): A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a first membrane having a first feed side and a first permeate side, wherein the first membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream across the first feed side;

(e) withdrawing from the first permeate side a first permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the first feed side a first residue stream that is enriched in C_2 hydrocarbons relative to the gas stream;

(g) providing a second membrane having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen;

(h) passing the first residue stream across the second feed side;

(i) withdrawing from the second feed side a second residue stream that is depleted in C_2 hydrocarbons relative to the first residue stream;

(j) withdrawing from the second permeate side a second permeate stream that is enriched

in C_2 hydrocarbons relative to the first residue stream; and

(k) passing the second permeate stream as a recycle stream back to step (a).

19. (Original): A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a point of the operation where the pressure is no more than 7 bar g.

20. (Original): A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a compressor downstream of a quench column.

21. (Original): A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a methanol-to-propylene reactor.

22. (Original): A process in accordance with Claim 18, wherein the first membrane comprises a glassy polymer.

23. (Original): A process in accordance with Claim 18, wherein the first membrane has a selectivity for hydrogen over ethylene of at least 10.

24. (Original): A process in accordance with Claim 18, wherein the first membrane has a hydrogen permeance of at least about 500 gpu.

25. (Original): A process in accordance with Claim 18, wherein the second membrane comprises a rubbery polymer.

26. (Original): A process in accordance with Claim 18, wherein the second membrane has a selectivity for ethylene over hydrogen of at least 4.

27. (Original): A process in accordance with Claim 18, wherein the second membrane has a C_2 hydrocarbon permeance of at least about 400 gpu.

28. (Original): A process in accordance with Claim 18, wherein the first membrane is also selective for carbon oxides over C_2 hydrocarbons.

29. (Original): A process in accordance with Claim 18, wherein the second membrane is also selective for C_2 hydrocarbons over carbon oxides.

REMARKS

Applicants have carefully read and considered the Official Action.

The Non-Final Office Action dated 04/07/2015 rejected claims 1-29. By this Amendment, claims 10-17 have been cancelled. Therefore, claims 1-9 and 18-29 are currently pending and under examination.

Examiner Interview

Applicants would like to thank Examiner Pregler for the opportunity to conduct a most helpful video interview regarding the subject application on June 25, 2015. Details of the interview are discussed below.

Turning now to the Detailed Action, the following remarks are set forth and responded to in the same order as presented therein.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, pages 2-6)

The Examiner rejected claims 1-3, 5-11, and 13-17 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar U.S. Patent No. 6,444,869 (hereinafter "Senetar") in view of Chewter U.S. PGPUB 2009/0187056 (hereinafter "Chewter").

At the outset, without responding to the propriety of the rejection and in order to expedite prosecution, claims 10-11 and 13-17 have been cancelled.

During a video interview with Examiner Pregler on June 25, 2015, Applicants gave a PowerPoint presentation and discussed the differences between the process disclosed in Senetar and the process recited by the present claims. Specifically, Applicants pointed out that step (c) of claim 1 recites a membrane that is selective to hydrogen over C_2 hydrocarbons, which is the exact opposite of the membrane taught by Senetar (*see* column 12, lines 33-36).

Applicants also discussed the pressure differences between a permeate stream and a residue stream during membrane separation. Applicants pointed to the data presented in Table 2 of the subject application to show that the permeate stream is withdrawn at low pressure (1 bar g) while the residue stream remains at relatively the same (high) pressure (34 bar g) as the feed stream (34 bar g). Applicants noted that the recycling of the residue stream in claim 1 at high pressure allows the stream to be routed back to any point in the process with minimal or no need for compression. In contrast, the process in Senetar, whether using pressure swing adsorption (PSA) or membrane separation, yields an ethylene stream that is desorbed/withdrawn at low pressure (see col. 12, lines 1-6 and col. 14, lines 8-10). Thus, the substitution of membranes yielding a high-pressure recovered hydrocarbons stream would require major engineering changes to the process of Senetar, since such a high-pressure hydrocarbons stream is not contemplated in Senetar.

Therefore, the teachings of Senetar in combination with Chewter would direct one of ordinary skill in the art away from using the membranes and/or recycle streams according to claims 1 and dependent claims 2-3 and 5-9.

Accordingly, Applicants respectfully request withdrawal of this rejection.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, page 6)

The Examiner rejected claims 4 and 12 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar in view of Chewter in view of Van Egmond U.S. Patent No. 7,626,067 (hereinafter "Van Egmond").

Without responding to the propriety of the rejection and in order to expedite prosecution, claim 12 has been cancelled. Claim 4 is dependent from claim 1 and is argued as patentable based on the distinctions between claim 1 and the combination of Senetar and Chewter presented above. The teachings of Van Egmond fail to overcome the deficiencies of Senetar in view of Chewter.

For these reasons, Applicants respectfully request withdrawal of this rejection.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, pages 7-9)

The Examiner rejected claims 18, 19 and 21-29 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar in view of Chewter and Baker et al. U.S. Patent No. 6,544,316 (hereinafter "Baker").

During the interview, Applicants discussed that Baker teaches a membrane that is selective for hydrogen over hydrocarbons, which is the opposite of the C_2 hydrocarbon-selective membrane recited in step (g) of claim 18. There is no disclosure by any of the cited references to combine unlike membranes according to claims 18, 19 and 21-29.

Therefore, the combination of Senetar in view of Chewter and Baker would direct a person of ordinary skill in the art away from attempting to arrive at the present invention as recited by claim 18 and dependent claims 19 and 21-29.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, page 10)

The Examiner rejected claim 20 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar in view of Baker in view of Chewter and in further view of Van Egmond.

Claim 20 is dependent from claim 18 and is argued as patentable on that basis. The teachings of Van Egmond do not overcome the deficiencies of Senetar in view of Baker in view of Chewter as discussed above. Thus, this rejection should be withdrawn.

Applicants respectfully request that this Amendment to the claims be entered and request reconsideration and allowance of claims 1-9 and 18-29 for the reasons advanced above. It is believed that the present Amendment and Response is fully responsive to the presently outstanding Official Action and should place the application in condition for allowance.

The Examiner is respectfully invited to call the undersigned at the number below if the prosecution of the subject application may be expedited by a telephone conference.

Respectfully submitted,

/Timothy A. Hott/

Timothy A. Hott
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CERTIFICATE OF ELECTRONIC SUBMISSION

I hereby certify that this correspondence is being submitted electronically with the United States Patent and Trademark Office on July 9, 2015.

Signature /JV/

Print name Jennifer Valcov

Electronic Patent Application Fee Transmittal

Application Number:	13776362
Filing Date:	25-Feb-2013
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Filer:	Janet E. Farrant/Jennifer Valcov
Attorney Docket Number:	976-177

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	2251	1	100	100
Miscellaneous:				
			Total in USD ($)	**100**

Electronic Acknowledgement Receipt

EFS ID:	22872824
Application Number:	13776362
International Application Number:	
Confirmation Number:	7293
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Customer Number:	26909
Filer:	Janet E. Farrant/Jennifer Valcov
Filer Authorized By:	Janet E. Farrant
Attorney Docket Number:	976-177
Receipt Date:	09-JUL-2015
Filing Date:	25-FEB-2013
Time Stamp:	15:55:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$100
RAM confirmation Number	2387
Deposit Account	505246
Authorized User	VALCOV, JENNIFER

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	177reply-20150709.pdf	167577 dda233e118de795dbfae4e754bf016565cb4c1b9	no	1
Warnings:					
Information:					
2	Claims	177claims20150709.pdf	953599 b16a8cfeb3cc5a12d83311c08e4dafeb3423ba1b	no	4
Warnings:					
Information:					
3	Applicant Arguments/Remarks Made in an Amendment	177remarks-20150709.pdf	1100639 d263112e83f962eb91c3ba21f1e8a8fbbb2896fc	no	4
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30226 2e47bed5307ac247e0bb2b092ad0d79808e7987a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2252041		

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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/776,362	02/25/2013	

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **07/09/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 21	Minus	** 29	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $210 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/Tina J. Barden/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:	Paul Su	Examiner:	S. Pregler
Serial number:	13/776,362	Group Art Unit:	1772
Filed:	February 25, 2013		
For:	MEMBRANE TECHNOLOGY FOR USE IN A METHANOL-TO-PROPYLENE CONVERSION PROCESS		

June 19, 2015

WRITTEN AUTHORIZATION BY APPLICANT TO COMMUNICATE WITH THE USPTO VIA INTERNET E-MAIL UNDER MPEP §502.03

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Madam:

Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file.

Respectfully submitted,

/Timothy A. Hott/

Timothy A. Hott
Registration No. 67,740
Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

Phone: 650-543-3370
Fax: 650-328-6580
E-mail: tim.hott@mtrinc.com

Electronic Acknowledgement Receipt

EFS ID:	22684477
Application Number:	13776362
International Application Number:	
Confirmation Number:	7293
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Customer Number:	26909
Filer:	Janet E. Farrant/Jennifer Valcov
Filer Authorized By:	Janet E. Farrant
Attorney Docket Number:	976-177
Receipt Date:	19-JUN-2015
Filing Date:	25-FEB-2013
Time Stamp:	14:05:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	177authorize-comm.pdf	222124 4e99e56f903b0a5dc7319e85b287882ab362f684	no	1

Warnings:	
Information:	

Total Files Size (in bytes):	222124

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	02/25/2013	Paul Su	976-177	7293

26909 7590 04/07/2015

Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

EXAMINER
PREGLER, SHARON

ART UNIT	PAPER NUMBER
1772	

MAIL DATE	DELIVERY MODE
04/07/2015	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 13/776,362	Applicant(s) SU, PAUL	
	Examiner SHARON PREGLER	Art Unit 1772	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12/10/14*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-29* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-29* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *2/25/13* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Response to Amendment

The Examiner acknowledges Applicant's response filed on 12/10/2014 containing remarks to the claims.

No claims have been amended, cancelled, or newly added.

Claims 1-29 are pending.

Applicant's request for reconsideration (see page 11 of remarks) of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-3, 5-11, and 13-17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Chewter US 2009/0187056 (hereinafter "Chewter").

Regarding claims 1 and 5, Senetar teaches a process comprising:

a) Converting oxygenate into light olefins including propylene (column 4 line 55). Senetar discloses that the conversion of methanol to light olefins is known in the art, thus oxygenate encompasses methanol (column 1 line 24). In Figure 2 the effluent from the oxygenate conversion process is carried through lines 100,105, through 111 to separator 126. A stream 112 comprising propylene is recovered (column 14 line 50).

b) A light stream 113 is removed from separator 126 containing light molecules including hydrogen, carbon monoxide, methane, ethylene, and ethane (column 8 lines 50-55 and column 14 line 51).

c) A membrane unit is provided in 132 (column 12 lines 33-41) naturally comprising a feed side (considered as the part accepting line 115 in Figure 2) and permeate side (opposite sides) ejecting lines 121 and 119 (column 15 lines 7-13);

d) A portion of the gas stream 115 is passed to the membrane 132 on the 'feed side;'

e) Withdrawing a permeate stream 121 depleted of C_2 relative to the gas stream 115;

f) Withdrawing a residue stream enriched 119 in ethylene (column 15 line 12).

Senetar teaches the residue stream 119 is recycled to a point after step a (to the compression unit 118, column 15 lines 12-15). Senetar does not explicitly teach recycling the residue stream to the MTO reactor.

However, Chewter teaches a process for converting methanol into olefins ([]) wherein the oxygenate stream may be diluted with an olefinic hydrocarbon stream and include an olefinic cofeed containing at least two carbon atoms ([0010], [0015], [0034] & [0036]), including ethylene ([0018]). Chewter discloses that the olefinic cofeed may be obtained from recycling ([0051]).

Thus, one having ordinary skill in the art would be motivated to modify Senetar by recycling the residue stream 119 containing ethylene to the MTO reactor as with Chewter because it has been found by Chewter that an olefinic cofeed provides the flexibility for more olefinic products ([0020]). Recycling ethylene to the reactor may provide higher olefins such as pentenes and hexenes, which are known marketable products for gasoline. Therefore depending on the market demand for ethylene or higher olefins, one having ordinary skill in the art would be motivated to make the combination because the modification would produce propylene and higher olefins simultaneously. (Recycling the residue stream to the MTO reactor is also pertinent to **claim 5**).

Regarding claim 2, Senetar in view of Chewter teach the residue C_2 stream is recycled to the MTO reactor as discussed above. The MTO reactor comprises a pressure of 7 kPa to 1.4 MPa (0.07 bar to 14 bar, column 5 line 65). The analogous feed stream 115 should comprise pressures of 2860 kPa to 4200 kPa (28.6 bar to 42

bar) because it is downstream of compressor 128 (column 14 line 67). Thus, Senetar teaches that the recycle is directed to a point at least 1 bar less than the feed stream pressure.

Regarding claim 3, Senetar teaches that stream 116 is directed to a deethanizer column (not pictured, column 15 lines 4-6). Senetar teaches the recycle 119 is directed to compressor 118 (Figure 2). Thus, Senetar teaches that the residue stream 119 is recyled to a point downstream of a deethanizer column.

Regarding claim 6, Senetar teaches the membrane comprises a glassy polymer (column 12 line 37).

Regarding claims 7 and 8, Senetar teaches from the graph in Figure 5 that the molar ratio of hydrogen and methane with respect to C_2 including ethylene approaches 100%. Thus it is implied that the permeance would comprise at least 10 or 500 gpu.

Regarding claim 9, Senetar teaches stream 121 comprises hydrogen and methane and stream 119 comprises ethylene (column 15 line 10), thus indicates that the membrane is selective toward hydrogen relative to C_2. Senetar further discloses that membranes selectivity toward carbon oxides over C_2 hydrocarbons are known to be used (column 3 lines 30-43).

Regarding claims 10 and 13, Senetar teaches a process comprising:

a) Converting oxygenate into light olefins including propylene (column 4 line 55). Senetar discloses that the conversion of methanol to light olefins is known in the art, thus oxygenate encompasses methanol (column 1 line 24). In Figure 2 the effluent from the oxygenate conversion process is carried through lines 100,105, through 111 to separator 126. A stream 112 comprising propylene is recovered (column 14 line 50).

b) A light stream 113 is removed from separator 126 containing light molecules including hydrogen, carbon monoxide, methane, ethylene, and ethane (column 8 lines 50-55 and column 14 line 51).

c) A membrane unit is provided in 132 (column 12 lines 33-41) naturally comprising a feed side (considered as the part accepting line 115 in Figure 2) and permeate side (opposite sides) ejecting lines 121 and 119 (column 15 lines 7-13);

d) A portion of the gas stream 115 is passed to the membrane 132 on the 'feed side;'

e) Withdrawing a residue stream 121 depleted of C_2 relative to the gas stream 115;

f) Withdrawing a permeate stream enriched 119 in ethylene (column 15 line 12).

Senetar teaches the permeate stream 119 is recycled to a point after step a (to the compression unit 118, column 15 lines 12-15). Senetar does not explicitly teach recycling the permeate stream to the MTO reactor.

However, Chewter teaches a process for converting methanol into olefins ([]) wherein the oxygenate stream may be diluted with an olefinic hydrocarbon stream and include an olefinic cofeed containing at least two carbon atoms ([0010], [0015], [0034] & [0036]), including ethylene ([0018]). Chewter discloses that the olefinic cofeed may be obtained from recycling ([0051]).

Thus, one having ordinary skill in the art would be motivated to modify Senetar by recycling the permeate stream 119 containing ethylene to the MTO reactor as with Chewter because it has been found by Chewter that an olefinic cofeed provides the flexibility for more olefinic products ([0020]). Recycling ethylene to the reactor may provide higher olefins such as pentenes and hexenes, which are known marketable products for gasoline. Therefore depending on the market demand for ethylene or higher olefins, one having ordinary skill in the art would be motivated to make the combination because the modification would produce propylene and higher olefins simultaneously. (Recycling the residue stream to the MTO reactor is also pertinent to **claim 13**).

Regarding claim 11, Senetar in view of Chewter teach the permeate C_2 stream is recycled to the MTO reactor as discussed above. The MTO reactor comprises a pressure of 7 kPa to 1.4 MPa (0.07 bar to 14 bar, column 5 line 65). The analogous feed stream 115 should comprise pressures of 2860 kPa to 4200 kPa (28.6 bar to 42 bar) because it is downstream of compressor 128 (column 14 line 67). Thus, Senetar teaches that the recycle is directed to a point that comprises no more than 7 bar than the feed stream pressure.

Regarding claim 14, Senetar teaches the membrane comprises a rubber polymer (column 12 line 37).

Regarding claims 15 and 16, Senetar teaches from the graph in Figure 5 that the molar ratio of hydrogen and methane with respect to C_2 including ethylene approaches 100%. Thus it is implied that the permeance would comprise at least 4 or 400 gpu.

Regarding claim 17, Senetar teaches stream 121 comprises hydrogen and methane and stream 119 comprises ethylene (column 15 line 10), thus indicates that the membrane is selective toward hydrogen relative to C_2. Senetar further discloses that membranes selectivity toward carbon oxides over C_2 hydrocarbons are known to be used (column 3 lines 30-43).

Claims 4 and 12 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Chewter US 2009/0187056 (hereinafter "Chewter") in view of Van Egmond 7,626,067 (hereinafter "Van Egmond").

Regarding claims 4 and 12, Senetar teaches the recycle 119 is directed to compressor 118 (Figure 2, column 15 line 14).

Senetar does not disclose a quench column and does not disclose recycling to a compressor downstream of a quench column.

However, Van Egmond teaches a process for converting oxygenates into olefins wherein a quench column 30 is placed after the reactor 20 (Figure 2). The quench column removes volatile compounds, catalyst fines, and oxygenate from the effluent stream before further separation.

Thus it is known to have a quench column after the reactor and it would have been obvious to one having ordinary skill in the art to have a quench column after the MTO in Senetar, in order to remove catalyst fines before compression 118, as evidenced by Van Egmond (column 9 lines 1-18). It would further be obvious to recycle the residue stream to the compression stage 118 after the quench tower in order to recover more ethylene.

Claims 18, 19, and 21-29 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Chewter US 2009/0187056 (hereinafter "Chewter") and Baker et al. US Patent 6,544,316 (hereinafter "Baker").

Regarding claims 18 and 21, Senetar teaches a process comprising:

a) Converting oxygenate into light olefins including propylene (column 4 line 55). Senetar discloses that the conversion of methanol to light olefins is known in the art, thus oxygenate encompasses methanol (column 1 line 24). In Figure 2 the effluent from the oxygenate conversion process is carried through lines 100,105, through 111 to separator 126. A stream 112 comprising propylene is recovered (column 14 line 50).

b) A light stream 113 is removed from separator 126 containing light molecules including hydrogen, carbon monoxide, methane, ethylene, and ethane (column 8 lines 50-55 and column 14 line 51).

c) A membrane unit is provided in 132 (column 12 lines 33-41) naturally comprising a feed side (considered as the part accepting line 115 in Figure 2) and permeate side (opposite sides) ejecting lines 121 and 119 (column 15 lines 7-13);

d) A portion of the gas stream 115 is passed to the membrane 132 on the 'feed side;'

e) Withdrawing a permeate stream 121 depleted of C_2 relative to the gas stream 115;

f) Withdrawing a residue stream enriched 119 in ethylene (column 15 line 12).

Senetar does not teach steps g-k comprising:

(g) providing a second membrane having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen;

(h) passing the first residue stream across the second feed side;

(i) withdrawing from the second feed side a second residue stream that is depleted in C_2 hydrocarbons relative to the first residue stream;

(j) withdrawing from the second permeate side a second permeate stream that is

enriched in C_2 hydrocarbons relative to the first residue stream; and

(k) passing the second permeate stream as a recycle stream back to step (a).

However, Baker teaches a process for separating hydrogen gas from a mixed hydrocarbon stream wherein the membrane is selective for hydrogen over the hydrocarbon including ethylene and ethane (abstract, column 4 lines 4-8, Figures 2-9). Baker teaches that there is an increasing demand for hydrogen sources for producing chemical feedstocks and liquefied petroleum gas (column 1 lines 60-67).

Therefore, it would have been obvious to one having ordinary skill in the art to combine Senetar and Baker by providing a second membrane (as taught by Baker) having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen. The second membrane would recover hydrogen from hydrocarbons which may be used for producing chemical feedstocks and liquefied petroleum gas (column 1 lines 60-67, column 4 lines 4-8, Figures 2-9).

Senetar teaches a residue stream 119 comprising ethylene is recycled to a point after step a (to the compression unit 118, column 15 lines 12-15). Senetar in view of Baker teach steps j-k, recoving hydrogen from a C_2 stream (column 4 lines 4-8, Figures 2-9). Senetar does not explicitly teach step k, recycling the C_2 residue stream to the MTO reactor.

However, Chewter teaches a process for converting methanol into olefins ([]) wherein the oxygenate stream may be diluted with an olefinic hydrocarbon stream and include an olefinic cofeed containing at least two carbon atoms ([0010], [0015], [0034] & [0036]), including ethylene ([0018]). Chewter discloses that the olefinic cofeed may be obtained from recycling ([0051]).

Thus, one having ordinary skill in the art would be motivated to modify Senetar and Baker by recycling the C_2 residue stream containing ethylene and/or ethane to the MTO reactor as with Chewter because it has been found by Chewter that an olefinic cofeed provides the flexibility for more olefinic products ([0020]). Recycling ethylene to the reactor may provide higher olefins such as pentenes and hexenes, which are known marketable products for gasoline. Therefore depending on the market demand for ethylene or higher olefins, one having ordinary skill in the art would be motivated to

make the combination because the modification would produce propylene and higher olefins simultaneously. (Recycling the residue stream to the MTO reactor is also pertinent to **claim 21**).

Regarding claim 19, Senetar in view of Chewter teach the permeate C_2 stream is recycled to the MTO reactor as discussed above. The MTO reactor comprises a pressure of 7 kPa to 1.4 MPa (0.07 bar to 14 bar, column 5 line 65). The analogous feed stream 115 should comprise pressures of 2860 kPa to 4200 kPa (28.6 bar to 42 bar) because it is downstream of compressor 128 (column 14 line 67). Thus, Senetar teaches that the recycle is directed to a point that comprises no more than 7 bar than the feed stream pressure.

Regarding claim 22, Senetar teaches the first membrane comprises a glassy polymer (column 12 line 37).

Regarding claims 23 and 24, Senetar teaches from the graph in Figure 5 that the molar ratio of hydrogen and methane with respect to C_2 including ethylene approaches 100%. Thus it is implied that the permeance of the first membrane would comprise at least 10 or 500 gpu.

Regarding claims 25-27, Baker teaches the second membrane comprises a rubber polymer (polyetherimide) wherein the selectivity of hydrogen to ethane comprises 20 and 44, thus at least 4 (Examples 4-5 and Figure 5).It is expected that a membrane made of similar material would have a similar permability as claimed.

Regarding claim 28, Senetar teaches stream 121 comprises hydrogen and methane and stream 119 comprises ethylene (column 15 line 10), thus indicates that the membrane is selective toward hydrogen relative to C_2. Senetar further discloses that membranes selectivity toward carbon oxides over C_2 hydrocarbons are known to be used (column 3 lines 30-43).

Regarding claim 29, Senetar further discloses that membranes selectivity toward carbon oxides over C_2 hydrocarbons are known to be used (column 3 lines 30-43).

Thus, it would have been obvious to implement a membrane that can isolate carbon dioxide from C_2 hydrocarbons.

Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Baker et al. US Patent 6,544,316 (hereinafter "Baker") in view of Chewter US 2009/0187056 (hereinafter "Chewter") and in further view of Van Egmond 7,626,067 (hereinafter "Van Egmond").

Regarding claim 20, Senetar teaches the recycle 119 is directed to compressor 118 (Figure 2, column 15 line 14).

Senetar does not disclose a quench column and does not disclose recycling to a compressor downstream of a quench column.

However, Van Egmond teaches a process for converting oxygenates into olefins wherein a quench column 30 is placed after the reactor 20 (Figure 2). The quench column removes volatile compounds, catalyst fines, and oxygenate from the effluent stream before further separation.

Thus it is known to have a quench column after the reactor and it would have been obvious to one having ordinary skill in the art to have a quench column after the MTO in Senetar, in order to remove catalyst fines before compression 118, as evidenced by Van Egmond (column 9 lines 1-18). It would further be obvious to recycle the residue stream to the compression stage 118 after the quench tower in order to recover more ethylene.

Response to Arguments

Applicant's arguments filed 12/10/2014 have been fully considered but they are not persuasive.

Applicant argues on page 7, last paragraph:

Senetar is cited as teaching a process that includes "e) [withdrawing a permeate stream 121 depleted of C2 relative to the gas stream 115" and "f) [w]ithdrawing a residue stream enriched 119 in ethylene (column 15 line 12)" (Non-Final Office Action, page 3). Senetar discloses that the membrane used in this separation is selective for ethylene axed other heavier components over hydrogen and methane (see column 12, iines 32-35), so that the membrane permeate stream will be selectively

enriched in C_{2+} hydrocarbons and the residue stream will be selectively depleted in C_{2+} hydrocarbons. In contrast, the present invention recites a process wherein a membrane is provided that is selective to hydrogen over C_2 hydrocarbons, meaning that tile process produces a permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream and a residue stream enriched in C_2 hydrocarbons relative to the gas stream (see claim 1), Thus, Senetar teaches the exact opposite of claims 1-3 and 5-9.

In response, the Examiner respectfully disagrees and asserts that Senetar teaches the limitations as presently claimed. Senetar teaches that stream 115 comprising lights (including ethylene (C_2), hydrogen, methane, and CO) is passed to a membrane separation unit 132. During the desorption step, a stream comprising hydrogen and methane 121 is obtained from ethylene stream 119. Therefore, the separation unit is selective to hydrogen over ethylene which reads on the instant limitation "selective to hydrogen over C_2 hydrocarbons."

Applicant argues on page 8:

Furthermore, Senetar is focused on pressure swing adsorption (PSA). The PSA processes of Senetar preferentially sorb the C_{2+} hydrocarbons, which are subsequently desorbed at low pressure (atmospheric to about 3.5 bar) to yield a recovered ethylene stream (see column 12, lines 1-6 and column I4, lines 8-10). Senetar teaches the use of membranes as a substitute for PSA or as an additional separation technique in conjunction with PSA. Thus, Senetar relies exclusively on specific membranes, such as rubbery or superglassy membranes (see column 12, lines 32-40) that will produce a relatively low-pressure permeate recovered hydrocarbons stream, comparable to the low-pressure desorbed recovered hydrocarbons stream obtained from PSA. Senetar does not disclose or suggest using any other membranes, especially not membranes that operate in a completely opposite way, as recited by claim 1, to yield a high-pressure residue recovered hydrocarbons stream. As indication of the typical pressure difference between the residue and permeate streams, see Tables 2 and 3 of Applicants' Examples 2 and 3, which show a residue pressure of 34 bar and a permeate pressure of 1 bar. Clearly, the substitution of membranes yielding a high-pressure recovered hydrocarbons stream would require major engineering changes to the process of Senetar, since such a high-pressure hydrocarbon stream is not contemplated in Senetar.

In response, the Examiner respectfully disagrees. It is noted that the instant claim is not restrictive to the type of absorption and merely recites "membrane selective to hydrogen over C_2 hydrocarons," which is addressed above. Since the claim is not restrictive to the type of membrane separation used, the limitation is met by Senetar.

Applicant argues on page 8, last paragraph:

Chewter is cited as teaching a process for converting methanol into olefins from a diluted olefinic hydrocarbon stream. The diluted olefinic hydrocarbon stream contains an oxygenate stream and an olefinic cofeed, the latter of which may be obtained from recycling (see Non-Final Office Action, page 3,

second full paragraph). Chewter discloses a process to prepare an olefin where the diluted olefinic hydrocarbon stream is contacted with a zeolite catalyst (see Abstract). Chewter further discloses that if the purpose of the process is to prepare propene, "the olefinic co-feed preferably contains only olefins having 4 carbon atoms" (paragraph [0020]). As a result, in one embodiment, the reaction product containing two or more olefins is separated into a fraction containing ethane and/or propene and another fraction containing C4+ olefins. The fraction containing C_{4+} olefins is recycled (see paragraph [0066]). Unlike Chewter, the process according to the present invention recycles a residue stream enriched in Ca hydrocarbons, not C_{4+} hydrocarbons (see claim 1).

In response, the Examiner disagrees. Although the Examiner acknowledges that Chewter prefers an C4+ olefin co-feed to produce propylene, Chewter does not teach away from using any olefin as a co-feed for the MTO process as indicated in paragraph [0017], where preferred olefins are in the range from 2 to 12 carbon atoms. Chewter has provided no detrimental effects of using light olefins as a diluent in the MTP process. Thus, it is taken that ethylene is suitable for a diluent in the MTP process and one having ordinary skill in the art would be motivated to recycle the residual stream containing olefins in Senetar to the MTP reactor.

Applicant argues on page 10, second paragraph:

Baker is cited by the Examiner as teaching “a process for separating hydrogen gas from a mixed hydrocarbon stream wherein the membrane is selective for hydrogen over the hydrocarbon including ethylene and ethane (abstract, column 4 lines 4-8, Figures 2-9)” (Non-Final Office Action, page 8, first full paragraph). Baker discloses that the permeate stream is enriched in hydrogen (i.e. depleted in C_2 hydrocarbons) and a residue stream depleted in hydrogen (i.e. enriched in C_2 hydrocarbons) (see column 4. lines 2-7). However, the second membrane of present invention discloses the exact opposite of Baker. In step (g) of claim 18, the second membrane is “selective to C_2 hydrocarbons over hydrogen.” Moreover, the present invention recites a permeate stream enriched in C_2 hydrocarbons and a residue stream depleted in C_2 hydrocarbons.

In response, the Examiner respectfully disagrees. The membrane of Baker separates H_2 from C_2 including ethylene and propylene as required by the instant claim. Baker provides motivation for obtaining a hydrogen stream from a C_2 stream as there is increasing demand for hydrogen (column 1 lines 60-67). In the process claim, patentable weight is given to the types of streams obtained from the separation, in this case hydrogen and a C_2 stream. The instant claim requires a membrane to obtain hydrogen from C_2 hydrocarbons which is met by Senetar and Baker. Therefore, the claims stand rejected under the cited references.

Applicant argues with respect to dependent claims by virtue of the arguments above. Since the arguments are not found persuasive at this point in the prosecution and the rejection is maintained, the rejections are also maintained for the dependent claims.

Conclusion

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHARON PREGLER whose telephone number is (571)270-5051. The examiner can normally be reached on Mon - Fri 8am-4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, In Suk Bullock can be reached on (571)272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SHARON PREGLER/
Examiner, Art Unit 1772

/PREM C SINGH/
Supervisory Patent Examiner, Art Unit 1771

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	Art Unit
	SHARON PREGLER	1772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/30/2014	03/25/2015							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
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	7	✓	✓							
	8	✓	✓							
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	24	✓	✓							
	25	✓	✓							
	26	✓	✓							
	27		✓							
	28		✓							
	29		✓							

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:	Paul Su	Examiner:	S. Pregler
Serial number:	13/776,362	Group Art Unit:	1772
Filed:	February 25, 2013		
For:	MEMBRANE TECHNOLOGY FOR USE IN A METHANOL-TO-PROPYLENE CONVERSION PROCESS		

December 10, 2014

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION MAILED 10/03/2014

Mail Stop Amendment
Hon. Commissioner of Patents and Trademarks
P.O. Box 1450
Alexandria, Virginia 22313-1450

Madam:

This communication is in response to the Non-Final Office Action dated October 3, 2014.

Listing of the Claims begins on page 2.

Remarks begin on page 7.

IN THE CLAIMS

1. (Original): A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream as a feed stream across the feed side;

(e) withdrawing from the permeate side a permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the feed side a residue stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the residue stream as a recycle stream back to step (a).

2. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a point of the operation where the pressure is at least 1 bar less than the feed stream pressure.

3. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a compressor located downstream of a de-ethanizer column.

4. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a compressor downstream of a quench column.

5. (Original): A process in accordance with Claim 1, wherein the residue stream is recycled back to a methanol-to-propylene reactor.

6. (Original): A process in accordance with Claim 1, wherein the membrane comprises a glassy polymer.

7. (Original): A process in accordance with Claim 1, wherein the membrane has a selectivity for hydrogen over ethylene of at least 10.

8. (Original): A process in accordance with Claim 1, wherein the membrane has a hydrogen permeance of at least about 500 gpu.

9. (Original): A process in accordance with Claim 1, wherein the membrane is also selective for carbon oxides over C_2 hydrocarbons.

10. (Original): A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to C_2 hydrocarbons over hydrogen;

(d) passing the gas stream across the feed side;

(e) withdrawing from the feed side a residue stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the permeate side a permeate stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the permeate stream as a recycle stream back to step (a).

11. (Original): A process in accordance with Claim 10, wherein the permeate stream is recycled back to a point of the operation where the pressure is no more than 7 bar g.

12. (Original): A process in accordance with Claim 10, wherein the permeate stream is recycled back to a compressor downstream of a quench column.

13. (Original): A process in accordance with Claim 10, wherein the permeate stream is recycled back to a methanol-to-propylene reactor.

14. (Original): A process in accordance with Claim 10, wherein the membrane comprises a rubbery polymer.

15. (Original): A process in accordance with Claim 10, wherein the membrane has a selectivity for ethylene over hydrogen of at least 4.

16. (Original): A process in accordance with Claim 10, wherein the membrane has a C_2 hydrocarbon permeance of at least about 400 gpu.

17. (Original): A process in accordance with Claim 10, wherein the membrane is also selective for carbon oxides over C_2 hydrocarbons.

18. (Original): A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a first membrane having a first feed side and a first permeate side, wherein the first membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream across the first feed side;

(e) withdrawing from the first permeate side a first permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the first feed side a first residue stream that is enriched in C_2 hydrocarbons relative to the gas stream;

(g) providing a second membrane having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen;

(h) passing the first residue stream across the second feed side;

(i) withdrawing from the second feed side a second residue stream that is depleted in C_2 hydrocarbons relative to the first residue stream;

(j) withdrawing from the second permeate side a second permeate stream that is enriched in C_2 hydrocarbons relative to the first residue stream; and

(k) passing the second permeate stream as a recycle stream back to step (a).

19. (Original): A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a point of the operation where the pressure is no more than 7 bar g.

20. (Original): A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a compressor downstream of a quench column.

21. (Original): A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a methanol-to-propylene reactor.

22. (Original): A process in accordance with Claim 18, wherein the first membrane comprises a glassy polymer.

23. (Original): A process in accordance with Claim 18, wherein the first membrane has a selectivity for hydrogen over ethylene of at least 10.

24. (Original): A process in accordance with Claim 18, wherein the first membrane has a hydrogen permeance of at least about 500 gpu.

25. (Original): A process in accordance with Claim 18, wherein the second membrane comprises a rubbery polymer.

26. (Original): A process in accordance with Claim 18, wherein the second membrane has a selectivity for ethylene over hydrogen of at least 4.

27. (Original): A process in accordance with Claim 18, wherein the second membrane has a C_2 hydrocarbon permeance of at least about 400 gpu.

28. (Original): A process in accordance with Claim 18, wherein the first membrane is also selective for carbon oxides over C_2 hydrocarbons.

29. (Original): A process in accordance with Claim 18, wherein the second membrane is also selective for C_2 hydrocarbons over carbon oxides.

REMARKS

Applicants have carefully read and considered the Official Action.

The Non-Final Office Action dated 10/03/2014 rejected claims 1-26. The Non-Final Office Action failed to acknowledge claims 27-29, which were submitted with the present specification on the filing date of 02/25/2013. Applicants brought this issue to the attention of the Examiner during a telephone call on November 12, 2014. No claims are amended. Therefore, claims 1-29 are currently pending and under examination.

The following remarks are set forth and responded to in the same order as presented in the Detailed Action.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, pages 2-6)

The Examiner rejected claims 1-3, 5-11, and 13-17 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar U.S. Patent No. 6,444,869 (hereinafter "Senetar") in view of Chewter U.S. PGPUB 2009/0187056 (hereinafter "Chewter").

Regarding Claims 1-3 and 5-9

Senetar is cited as teaching a process that includes "e) [w]ithdrawing a permeate stream 121 depleted of C2 relative to the gas stream 115" and "f) [w]ithdrawing a residue stream enriched 119 in ethylene (column 15 line 12)" (Non-Final Office Action, page 3). Senetar discloses that the membrane used in this separation is selective for ethylene and other heavier components over hydrogen and methane (*see* column 12, lines 32-35), so that the membrane permeate stream will be selectively enriched in C_{2+} hydrocarbons and the residue stream will be selectively depleted in C_{2+} hydrocarbons. In contrast, the present invention recites a process wherein a membrane is provided that is selective to hydrogen over C_2 hydrocarbons, meaning that the process produces a permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream and a residue stream enriched in C_2 hydrocarbons relative to the gas stream (*see* claim 1). Thus, Senetar teaches the exact opposite of claims 1-3 and 5-9.

Furthermore, Senetar is focused on pressure swing adsorption (PSA). The PSA processes of Senetar preferentially sorb the C_{2+} hydrocarbons, which are subsequently desorbed at low pressure (atmospheric to about 3.5 bar) to yield a recovered ethylene stream (*see* column 12, lines 1-6 and column 14, lines 8-10). Senetar teaches the use of membranes as a substitute for PSA or as an additional separation technique in conjunction with PSA. Thus, Senetar relies exclusively on specific membranes, such as rubbery or superglassy membranes (*see* column 12, lines 32-40) that will produce a relatively low-pressure permeate recovered hydrocarbons stream, comparable to the low-pressure desorbed recovered hydrocarbons stream obtained from PSA. Senetar does not disclose or suggest using any other membranes, especially not membranes that operate in a completely opposite way, as recited by claim 1, to yield a high-pressure residue recovered hydrocarbons stream. As indication of the typical pressure difference between the residue and permeate streams, see Tables 2 and 3 of Applicants' Examples 2 and 3, which show a residue pressure of 34 bar and a permeate pressure of 1 bar. Clearly, the substitution of membranes yielding a high-pressure recovered hydrocarbons stream would require major engineering changes to the process of Senetar, since such a high-pressure hydrocarbon stream is not contemplated in Senetar.

Chewter is cited as teaching a process for converting methanol into olefins from a diluted olefinic hydrocarbon stream. The diluted olefinic hydrocarbon stream contains an oxygenate stream and an olefinic cofeed, the latter of which may be obtained from recycling (*see* Non-Final Office Action, page 3, second full paragraph). Chewter discloses a process to prepare an olefin where the diluted olefinic hydrocarbon stream is contacted with a zeolite catalyst (*see* Abstract). Chewter further discloses that if the purpose of the process is to prepare propene, "the olenfinic co-feed preferably contains only olefins having 4 carbon atoms" (paragraph [0020]). As a result, in one embodiment, the reaction product containing two or more olefins is separated into a fraction containing ethane and/or propene and another fraction containing C_{4+} olefins. The fraction containing C_{4+} olefins is recycled (*see* paragraph [0066]). Unlike Chewter, the process according to the present invention recycles a residue stream enriched in C_2 hydrocarbons, not C_{4+} hydrocarbons (*see* claim 1).

Therefore, the teachings of Senetar in combination with Chewter would direct one of ordinary skill in the art away from using the membranes and/or recycle streams according to claims 1 and dependent claims 2-3 and 5-9.

Regarding Claims 10-11 and 13-17

The Examiner correctly points out that Senetar fails to teach the recycling of a permeate stream to a MTO reactor (Non-Final Office Action, page 5, first full paragraph). As discussed above, Chewter discloses that the stream being recycled contains C_{4+} olefins (*see* paragraph [0066]). However, unlike Chewter, the process according to the present invention recycles a permeate stream enriched in C_2 hydrocarbons, not C_{4+} hydrocarbons (*see* claim 10).

Thus, the combination of Senetor in view of Chewter would not direct one of ordinary skill in the art to attempt to arrive at the present invention according to claim 10 and dependent claims 11 and 13-17.

Accordingly, Applicants respectfully request withdrawal of this rejection.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, pages 6-7)

The Examiner rejected claims 4 and 12 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar in view of Chewter in view of Van Egmond U.S. Patent No. 7,626,067 (hereinafter "Van Egmond").

This rejection cited the same references as above except for the addition of Van Egmond. The distinctions of claims 1 and 10, from which claims 4 and 12 depend, respectively, are pointed out above and are also reiterated here. The teachings of Van Egmond, however, fail to overcome the deficiencies of Senetar in view of Chewter as previously discussed. Therefore, the combination of Senetar in view of Chewter in view of Van Egmond would direct a person of ordinary skill in the art away from attempting to arrive at the present invention.

Thus, Applicants respectfully request withdrawal of this rejection.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, pages 7-9)

The Examiner rejected claims 18, 19 and 21-26 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar in view of Chewter and Baker et al. U.S. Patent No. 6,544,316 (hereinafter "Baker").

Baker is cited by the Examiner as teaching "a process for separating hydrogen gas from a mixed hydrocarbon stream wherein the membrane is selective for hydrogen over the hydrocarbon including ethylene and ethane (abstract, column 4 lines 4-8, Figures 2-9)" (Non-Final Office Action, page 8, first full paragraph). Baker discloses that the permeate stream is enriched in hydrogen (*i.e.* depleted in C_2 hydrocarbons) and a residue stream depleted in hydrogen (*i.e.* enriched in C_2 hydrocarbons) (*see* column 4, lines 2-7). However, the second membrane of present invention discloses the exact opposite of Baker. In step (g) of claim 18, the second membrane is "selective to C_2 hydrocarbons over hydrogen." Moreover, the present invention recites a permeate stream enriched in C_2 hydrocarbons and a residue stream depleted in C_2 hydrocarbons.

In addition, Baker does not overcome the deficiencies of Senetar in view of Chewter, as discussed above. There is no disclosure by any of the cited references to combine unlike membranes according to claims 18, 19 and 21-26. Therefore, the combination of Senetar in view of Chewter and Baker would direct a person of ordinary skill in the art away from attempting to arrive at the present invention as recited by claim 18 and dependent claims 19 and 21-26.

Claim Rejections- 35 U.S.C. §103(a)(Office Action, page 10)

The Examiner rejected claim 20 under 35 U.S.C. §103(a) as allegedly being unpatentable over Senetar in view of Baker in view of Chewter and in further view of Van Egmond.

The arguments advanced above in connection with the previous rejection concerning claim 18 are reiterated here. Claim 20 is dependent from claim 18 and is argued as patentable on that

basis. Moreover, the teachings of Van Egmond do not overcome the deficiencies of Senetar in view of Baker in view of Chewter as described above. Thus, this rejection should be withdrawn.

Finality of the Next Action is Precluded

Applicants respectfully submit that the Examiner's inadvertent failure to acknowledge claims 27-29 precludes the finality of a next office action rejecting those claims, because such a rejection will not have been necessitated by either a claim amendment or based on information from an information disclosure statement (*see* MPEP § 706.07(a)).

Applicants respectfully request that this amendment to the claims be entered and request reconsideration and allowance of claims 1-29 for the reasons advanced above. It is believed that the present Amendment and Response is fully responsive to the presently outstanding Official Action and should place the application in condition for allowance.

The Examiner is respectfully invited to call the undersigned at the number below if the prosecution of the subject application may be expedited by a telephone conference.

Respectfully submitted,

/Timothy A. Hott/

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CERTIFICATE OF ELECTRONIC SUBMISSION

I hereby certify that this correspondence is being submitted electronically with the United States Patent and Trademark Office on December 10, 2014.

Signature /JV/

Print name Jennifer Valcov

Electronic Acknowledgement Receipt

EFS ID:	20920060
Application Number:	13776362
International Application Number:	
Confirmation Number:	7293
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Customer Number:	26909
Filer:	Janet E. Farrant/Jennifer Valcov
Filer Authorized By:	Janet E. Farrant
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Time Stamp:	14:15:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	177response1.pdf	169001 726e6ff641e7b19572e35a5cf3d63797239c257d	no	1

Warnings:	
Information:	

2	Claims	177amendedclaims1.pdf	1282574 49cbc04b846be20741c69ec53bf9fe6a254c514e	no	5
Warnings:					
Information:					
3	Applicant Arguments/Remarks Made in an Amendment	177remarks1.pdf	1833957 f9f1b704cb40dd5849c49a8597c337062d29f9b3	no	6
Warnings:					
Information:					
			Total Files Size (in bytes):	3285532	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/776,362	02/25/2013	

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **12/10/2014**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 29	Minus	** 29	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/DEBORAH PORTER/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/776,362	02/25/2013	Paul Su	976-177	7293

26909 7590 10/03/2014

Membrane Technology and Research, Inc.
39630 Eureka Drive
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EXAMINER	
PREGLER, SHARON	
ART UNIT	PAPER NUMBER
1772	
MAIL DATE	DELIVERY MODE
10/03/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 13/776,362	Applicant(s) SU, PAUL	
	Examiner SHARON PREGLER	Art Unit 1772	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2/25/2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-26* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-26* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *2/25/2013* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-3, 5-11, and 13-17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Chewter US 2009/0187056 (hereinafter "Chewter").

Regarding claims 1 and 5, Senetar teaches a process comprising:

a) Converting oxygenate into light olefins including propylene (column 4 line 55). Senetar discloses that the conversion of methanol to light olefins is known in the art, thus oxygenate encompasses methanol (column 1 line 24). In Figure 2 the effluent from

the oxygenate conversion process is carried through lines 100,105, through 111 to separator 126. A stream 112 comprising propylene is recovered (column 14 line 50).

b) A light stream 113 is removed from separator 126 containing light molecules including hydrogen, carbon monoxide, methane, ethylene, and ethane (column 8 lines 50-55 and column 14 line 51).

c) A membrane unit is provided in 132 (column 12 lines 33-41) naturally comprising a feed side (considered as the part accepting line 115 in Figure 2) and permeate side (opposite sides) ejecting lines 121 and 119 (column 15 lines 7-13);

d) A portion of the gas stream 115 is passed to the membrane 132 on the 'feed side;'

e) Withdrawing a permeate stream 121 depleted of C_2 relative to the gas stream 115;

f) Withdrawing a residue stream enriched 119 in ethylene (column 15 line 12).

Senetar teaches the residue stream 119 is recycled to a point after step a (to the compression unit 118, column 15 lines 12-15). Senetar does not explicitly teach recycling the residue stream to the MTO reactor.

However, Chewter teaches a process for converting methanol into olefins ([]) wherein the oxygenate stream may be diluted with an olefinic hydrocarbon stream and include an olefinic cofeed containing at least two carbon atoms ([0010], [0015], [0034] & [0036]), including ethylene ([0018]). Chewter discloses that the olefinic cofeed may be obtained from recycling ([0051]).

Thus, one having ordinary skill in the art would be motivated to modify Senetar by recycling the residue stream 119 containing ethylene to the MTO reactor as with Chewter because it has been found by Chewter that an olefinic cofeed provides the flexibility for more olefinic products ([0020]). Recycling ethylene to the reactor may provide higher olefins such as pentenes and hexenes, which are known marketable products for gasoline. Therefore depending on the market demand for ethylene or higher olefins, one having ordinary skill in the art would be motivated to make the combination because the modification would produce propylene and higher olefins

simultaneously. (Recycling the residue stream to the MTO reactor is also pertinent to **claim 5**).

Regarding claim 2, Senetar in view of Chewter teach the residue C_2 stream is recycled to the MTO reactor as discussed above. The MTO reactor comprises a pressure of 7 kPa to 1.4 MPa (0.07 bar to 14 bar, column 5 line 65). The analogous feed stream 115 should comprise pressures of 2860 kPa to 4200 kPa (28.6 bar to 42 bar) because it is downstream of compressor 128 (column 14 line 67). Thus, Senetar teaches that the recycle is directed to a point at least 1 bar less than the feed stream pressure.

Regarding claim 3, Senetar teaches that stream 116 is directed to a deethanizer column (not pictured, column 15 lines 4-6). Senetar teaches the recycle 119 is directed to compressor 118 (Figure 2). Thus, Senetar teaches that the residue stream 119 is recyled to a point downstream of a deethanizer column.

Regarding claim 6, Senetar teaches the membrane comprises a glassy polymer (column 12 line 37).

Regarding claims 7 and 8, Senetar teaches from the graph in Figure 5 that the molar ratio of hydrogen and methane with respect to C_2 including ethylene approaches 100%. Thus it is implied that the permeance would comprise at least 10 or 500 gpu.

Regarding claim 9, Senetar teaches stream 121 comprises hydrogen and methane and stream 119 comprises ethylene (column 15 line 10), thus indicates that the membrane is selective toward hydrogen relative to C_2. Senetar further discloses that membranes selectivity toward carbon oxides over C_2 hydrocarbons are known to be used (column 3 lines 30-43).

Regarding claims 10 and 13, Senetar teaches a process comprising:

a) Converting oxygenate into light olefins including propylene (column 4 line 55). Senetar discloses that the conversion of methanol to light olefins is known in the art, thus oxygenate encompasses methanol (column 1 line 24). In Figure 2 the effluent from the oxygenate conversion process is carried through lines 100,105, through 111 to separator 126. A stream 112 comprising propylene is recovered (column 14 line 50).

b) A light stream 113 is removed from separator 126 containing light molecules including hydrogen, carbon monoxide, methane, ethylene, and ethane (column 8 lines 50-55 and column 14 line 51).

c) A membrane unit is provided in 132 (column 12 lines 33-41) naturally comprising a feed side (considered as the part accepting line 115 in Figure 2) and permeate side (opposite sides) ejecting lines 121 and 119 (column 15 lines 7-13);

d) A portion of the gas stream 115 is passed to the membrane 132 on the 'feed side;'

e) Withdrawing a residue stream 121 depleted of C_2 relative to the gas stream 115;

f) Withdrawing a permeate stream enriched 119 in ethylene (column 15 line 12).

Senetar teaches the permeate stream 119 is recycled to a point after step a (to the compression unit 118, column 15 lines 12-15). Senetar does not explicitly teach recycling the permeate stream to the MTO reactor.

However, Chewter teaches a process for converting methanol into olefins ([]) wherein the oxygenate stream may be diluted with an olefinic hydrocarbon stream and include an olefinic cofeed containing at least two carbon atoms ([0010], [0015], [0034] & [0036]), including ethylene ([0018]). Chewter discloses that the olefinic cofeed may be obtained from recycling ([0051]).

Thus, one having ordinary skill in the art would be motivated to modify Senetar by recycling the permeate stream 119 containing ethylene to the MTO reactor as with Chewter because it has been found by Chewter that an olefinic cofeed provides the flexibility for more olefinic products ([0020]). Recycling ethylene to the reactor may provide higher olefins such as pentenes and hexenes, which are known marketable products for gasoline. Therefore depending on the market demand for ethylene or higher olefins, one having ordinary skill in the art would be motivated to make the combination because the modification would produce propylene and higher olefins simultaneously. (Recycling the residue stream to the MTO reactor is also pertinent to **claim 13**).

Regarding claim 11, Senetar in view of Chewter teach the permeate C_2 stream is recycled to the MTO reactor as discussed above. The MTO reactor comprises a pressure of 7 kPa to 1.4 MPa (0.07 bar to 14 bar, column 5 line 65). The analogous feed stream 115 should comprise pressures of 2860 kPa to 4200 kPa (28.6 bar to 42 bar) because it is downstream of compressor 128 (column 14 line 67). Thus, Senetar teaches that the recycle is directed to a point that comprises no more than 7 bar than the feed stream pressure.

Regarding claim 14, Senetar teaches the membrane comprises a rubber polymer (column 12 line 37).

Regarding claims 15 and 16, Senetar teaches from the graph in Figure 5 that the molar ratio of hydrogen and methane with respect to C_2 including ethylene approaches 100%. Thus it is implied that the permeance would comprise at least 4 or 400 gpu.

Regarding claim 17, Senetar teaches stream 121 comprises hydrogen and methane and stream 119 comprises ethylene (column 15 line 10), thus indicates that the membrane is selective toward hydrogen relative to C_2. Senetar further discloses that membranes selectivity toward carbon oxides over C_2 hydrocarbons are known to be used (column 3 lines 30-43).

Claims 4 and 12 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Chewter US 2009/0187056 (hereinafter "Chewter") in view of Van Egmond 7,626,067 (hereinafter "Van Egmond").

Regarding claims 4 and 12, Senetar teaches the recycle 119 is directed to compressor 118 (Figure 2, column 15 line 14).

Senetar does not disclose a quench column and does not disclose recycling to a compressor downstream of a quench column.

However, Van Egmond teaches a process for converting oxygenates into olefins wherein a quench column 30 is placed after the reactor 20 (Figure 2). The quench

column removes volatile compounds, catalyst fines, and oxygenate from the effluent stream before further separation.

Thus it is known to have a quench column after the reactor and it would have been obvious to one having ordinary skill in the art to have a quench column after the MTO in Senetar, in order to remove catalyst fines before compression 118, as evidenced by Van Egmond (column 9 lines 1-18). It would further be obvious to recycle the residue stream to the compression stage 118 after the quench tower in order to recover more ethylene.

Claims 18, 19, and 21-26 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Chewter US 2009/0187056 (hereinafter "Chewter") and Baker et al. US Patent 6,544,316 (hereinafter "Baker").

Regarding claims 18 and 21, Senetar teaches a process comprising:

a) Converting oxygenate into light olefins including propylene (column 4 line 55). Senetar discloses that the conversion of methanol to light olefins is known in the art, thus oxygenate encompasses methanol (column 1 line 24). In Figure 2 the effluent from the oxygenate conversion process is carried through lines 100,105, through 111 to separator 126. A stream 112 comprising propylene is recovered (column 14 line 50).

b) A light stream 113 is removed from separator 126 containing light molecules including hydrogen, carbon monoxide, methane, ethylene, and ethane (column 8 lines 50-55 and column 14 line 51).

c) A membrane unit is provided in 132 (column 12 lines 33-41) naturally comprising a feed side (considered as the part accepting line 115 in Figure 2) and permeate side (opposite sides) ejecting lines 121 and 119 (column 15 lines 7-13);

d) A portion of the gas stream 115 is passed to the membrane 132 on the 'feed side;'

e) Withdrawing a permeate stream 121 depleted of C_2 relative to the gas stream 115;

f) Withdrawing a residue stream enriched 119 in ethylene (column 15 line 12).

Senetar does not teach steps g-k comprising:

(g) providing a second membrane having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen;

(h) passing the first residue stream across the second feed side;

(i) withdrawing from the second feed side a second residue stream that is depleted in C_2 hydrocarbons relative to the first residue stream;

(j) withdrawing from the second permeate side a second permeate stream that is enriched in C_2 hydrocarbons relative to the first residue stream; and

(k) passing the second permeate stream as a recycle stream back to step (a).

However, Baker teaches a process for separating hydrogen gas from a mixed hydrocarbon stream wherein the membrane is selective for hydrogen over the hydrocarbon including ethylene and ethane (abstract, column 4 lines 4-8, Figures 2-9). Baker teaches that there is an increasing demand for hydrogen sources for producing chemical feedstocks and liquefied petroleum gas (column 1 lines 60-67).

Therefore, it would have been obvious to one having ordinary skill in the art to combine Senetar and Baker by providing a second membrane (as taught by Baker) having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen. The second membrane would recover hydrogen from hydrocarbons which may be used for producing chemical feedstocks and liquefied petroleum gas (column 1 lines 60-67, column 4 lines 4-8, Figures 2-9).

Senetar teaches a residue stream 119 comprising ethylene is recycled to a point after step a (to the compression unit 118, column 15 lines 12-15). Senetar in view of Baker teach steps j-k, recoving hydrogen from a C_2 stream (column 4 lines 4-8, Figures 2-9). Senetar does not explicitly teach step k, recycling the C_2 residue stream to the MTO reactor.

However, Chewter teaches a process for converting methanol into olefins ([]) wherein the oxygenate stream may be diluted with an olefinic hydrocarbon stream and include an olefinic cofeed containing at least two carbon atoms ([0010], [0015], [0034] &

[0036]), including ethylene ([0018]). Chewter discloses that the olefinic cofeed may be obtained from recycling ([0051]).

Thus, one having ordinary skill in the art would be motivated to modify Senetar and Baker by recycling the C_2 residue stream containing ethylene and/or ethane to the MTO reactor as with Chewter because it has been found by Chewter that an olefinic cofeed provides the flexibility for more olefinic products ([0020]). Recycling ethylene to the reactor may provide higher olefins such as pentenes and hexenes, which are known marketable products for gasoline. Therefore depending on the market demand for ethylene or higher olefins, one having ordinary skill in the art would be motivated to make the combination because the modification would produce propylene and higher olefins simultaneously. (Recycling the residue stream to the MTO reactor is also pertinent to **claim 21**).

Regarding claim 19, Senetar in view of Chewter teach the permeate C_2 stream is recycled to the MTO reactor as discussed above. The MTO reactor comprises a pressure of 7 kPa to 1.4 MPa (0.07 bar to 14 bar, column 5 line 65). The analogous feed stream 115 should comprise pressures of 2860 kPa to 4200 kPa (28.6 bar to 42 bar) because it is downstream of compressor 128 (column 14 line 67). Thus, Senetar teaches that the recycle is directed to a point that comprises no more than 7 bar than the feed stream pressure.

Regarding claim 22, Senetar teaches the first membrane comprises a glassy polymer (column 12 line 37).

Regarding claims 23 and 24, Senetar teaches from the graph in Figure 5 that the molar ratio of hydrogen and methane with respect to C_2 including ethylene approaches 100%. Thus it is implied that the permeance of the first membrane would comprise at least 10 or 500 gpu.

Regarding claims 25-26, Baker teaches the second membrane comprises a rubber polymer (polyetherimide) wherein the selectivity of hydrogen to ethane comprises 20 and 44, thus at least 4 (Examples 4-5 and Figure 5).

Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Senetar US Patent 6,444,869 (hereinafter "Senetar") in view of Baker et al. US Patent 6,544,316 (hereinafter "Baker") in view of Chewter US 2009/0187056 (hereinafter "Chewter") and in further view of Van Egmond 7,626,067 (hereinafter "Van Egmond").

Regarding claim 20, Senetar teaches the recycle 119 is directed to compressor 118 (Figure 2, column 15 line 14).

Senetar does not disclose a quench column and does not disclose recycling to a compressor downstream of a quench column.

However, Van Egmond teaches a process for converting oxygenates into olefins wherein a quench column 30 is placed after the reactor 20 (Figure 2). The quench column removes volatile compounds, catalyst fines, and oxygenate from the effluent stream before further separation.

Thus it is known to have a quench column after the reactor and it would have been obvious to one having ordinary skill in the art to have a quench column after the MTO in Senetar, in order to remove catalyst fines before compression 118, as evidenced by Van Egmond (column 9 lines 1-18). It would further be obvious to recycle the residue stream to the compression stage 118 after the quench tower in order to recover more ethylene.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHARON PREGLER whose telephone number is (571)270-5051. The examiner can normally be reached on Mon - Fri 8am-4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, In Suk Bullock can be reached on (571)272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SHARON PREGLER/
Examiner, Art Unit 1772

/IN SUK BULLOCK/
Supervisory Patent Examiner, Art Unit 1772

Notice of References Cited	Application/Control No. 13/776,362	Applicant(s)/Patent Under Reexamination SU, PAUL	
	Examiner SHARON PREGLER	Art Unit 1772	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,444,869	09-2002	Senetar et al.	585/809
*	B	US-2009/0187056	07-2009	Chewter et al.	585/638
*	C	US-7,626,067	12-2009	Van Egmond et al.	585/640
*	D	US-6,544,316	04-2003	Baker et al.	95/55
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	Art Unit
	SHARON PREGLER	1772

CPC- SEARCHED		
Symbol	Date	Examiner
C07C7/00,11,12,144	9/30/2014	SKP
C07C1/$	9/30/2014	SKP

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
585	638,639,640,641	9/30/2014	SKP

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search Attached	9/30/2014	SKP

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/SHARON PREGLER/ Examiner.Art Unit 1772	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"6444869".pn. and carbon monoxide	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 10:28
L2	2	"20090187056"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 11:08
L3	2	"20090187056" and diluent and ethylene	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 11:15
L4	1	"20090187056" and diluent and ethylene same (reactor or recycle)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 11:20
L5	1	"6444869".pn. and ethylene and recycl$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 11:20
L6	0	"20090187056" and diluent and cofeed	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 12:09
L7	2	"20090187056" and diluent and co$1feed	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 12:09
L9	35	(US-20130303819-$ or US-	US-PGPUB;	WITH	ON	2014/09/30

		20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$ or US-20090187056-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$).did.	USPAT			12:44
L10	13	L9 and hydrogen selectiv$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 12:44
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L12	2	"6544316".pn. and hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 13:06
L13	2	"7626067".pn. and quench	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 13:32
L14	1	"6444869".pn. and glassy	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 14:25
L15	0	"6444869".pn. and glassy polymer	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 14:25
L16	2	"6444869".pn. and carbon monoxide	US-PGPUB;	WITH	ON	2014/09/30

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:45
L17	0	"6544316".pn. and rubber polymer	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 15:02
L18	0	"6544316".pn. and rubber	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 15:02
L19	0	"6544316".pn. and rubber$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 15:02
L20	2	"6544316".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 15:02
L21	1	"6544316".pn. and material and selectiv$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/30 15:03
S1	1	"13776362"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:35
S2	388	methanol and (propylene or propene) and C07C1/$.cpc. and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:35
S3	2	("6544316").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	WITH	ON	2014/09/23 15:36

			IBM_TDB			
S4	27	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same glassy polymer	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:37
S5	10	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same glassy polymer and (ethani$3 or deethani$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:40
S6	16	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same glassy polymer and (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene) same membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/23 15:43
S7	375	methanol and (propylene or propene) and C07C1/$.cpc. and membrane and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:42
S8	248	S7 and (compress$3 and quench$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:43
S9	28	S8 and (glass$3 polymer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:43
S10	453	methanol and (propylene or propene) and (C07C7/00,11,12,144.CPC. or C07C1/$.cpc.) and membrane and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:47
S11	274	S10 and (compress$3 and quench$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:47
S12	34	S10 and (compress$3 and quench$3) and glass$4 polymer	US-PGPUB; USPAT; USOCR; FPRS;	WITH	ON	2014/09/29 14:48

			EPO; JPO; DERWENT; IBM_TDB			
S13	15	S10 and (permea$4 gpu)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:49
S14	15	S10 and (permea$4 gpu) same membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:49
S15	25	S10 and ((ethylene or ethene) same hydrogen select$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:54
S16	4	S10 and ((ethylene or ethene) same hydrogen select$4 same membrane)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:54
S17	9	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 14:57
S18	5	S17 and selectiv$4 same hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:57
S19	5	S12 and selectivity same (light or hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 14:59
S20	357	methanol and (propylene or propene) and (C07C7/00,11,12,144.CPC. or C07C1/$.cpc.) and membrane same (separat$4 or recover$4) and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:02
S21	77	methanol and (propylene or propene) and (C07C7/00,11,12,144.CPC. or C07C1/$.cpc.) and membrane same	US-PGPUB; USPAT; USOCR;	WITH	ON	2014/09/29 15:02

		(separat$4 or recover$4) and hydrogen selectiv$4 and (ethylene or ethene)	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S22	248	methanol and (propylene or propene) and C07C1/$.cpc. and membrane and hydrogen and (ethylene or ethene) and compress$4 and quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:04
S23	187	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same separat$4 and hydrogen and (ethylene or ethene) and compress$4 and quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:04
S24	74	methanol and (propylene or propene) and C07C1/$.cpc. and membrane same separat$4 and hydrogen same selectiv$4 and (ethylene or ethene) and compress$4 and quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:04
S25	1	S17 and S24	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:07
S26	13701	methanol and (propylene or propene) and membrane same (separat$4 or recover$4) and hydrogen and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:07
S27	1352	methanol and (propylene or propene) and membrane same (separat$4 or recover$4) and hydrogen selectiv$4 and (ethylene or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:10
S28	58	S27 and C07C1/$.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:13
S29	2	"6264828".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:13
S30	8	"6141988"	US-PGPUB;	WITH	ON	2014/09/29

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:15
S31	3	"6141988" and methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:15
S32	14	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 15:16
S33	91	C07C1/00,24,22.cpc. and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S34	67	C07C1/00,24,22.cpc. and membrane same (recover or separat$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S35	9	C07C1/00,24,22.cpc. and membrane same (recover or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S36	11	C07C1/00,24,22.cpc. and membrane same (recover or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:18
S37	141	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recover or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:19
S38	143	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recov$3 or separat$4) and (hydrogen or light or methane)	US-PGPUB; USPAT; USOCR; FPRS;	WITH	ON	2014/09/29 15:24

		(selectiv$4 or permeat$4 or permeab$6)	EPO; JPO; DERWENT; IBM_TDB			
S39	104	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recov$3 or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6) and quench$4 and compress$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:24
S40	104	(C07C1/00,24,22.cpc. or 585/638,639,640,641.ccls.) and membrane same (recov$3 or separat$4) and (hydrogen or light or methane) (selectiv$4 or permeat$4 or permeab$6) and quench$3 and compress$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 15:25
S41	18	("20050150817" | "20070007175" | "20080154078" | "4257877" | "4423264" | "5026936" | "5371308" | "5523502" | "6049017" | "6090270" | "6646176" | "7128827" | "7161051" | "7431821" | "7601309" | "7728185" | "7732650" | "7741526").PN. OR ("8829259").URPN.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 15:28
S42	2	S41 and membrane	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 15:29
S43	2	S41 and membrane and hydrogen	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 15:29
S44	15	(("5082481") or ("6069288") or ("5904880") or ("5927063") or ("6121503") or ("5927063")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/09/29 15:52
S45	241	methanol and (propylene or propene) and C07C1/$.cpc. and membrane (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:05
S46	227	methanol and (propylene or propene) and C07C1/$.cpc. and membrane (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene or methane) and (membrane or separat$4 or recover) same (hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:05
S47	218	methanol and (propylene or propene) and C07C1/00,20,24,22.cpc. and membrane (membrane or separat$4 or recover) same (C2 or ethylene or ethane or ethene or methane) and (membrane or separat$4 or recover) same (hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:45
S48	180	methanol and (propylene or propene) and C07C1/00,20,24,22.cpc. and	US-PGPUB; USPAT;	WITH	ON	2014/09/29 16:48

		membrane (membrane or separat$4 or recover) (C2 or ethylene or ethane or ethene or methane) and (membrane or separat$4 or recover) (hydrogen)	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S49	120	S48 and 585/638,639,640,641.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:48
S50	179	methanol and (propylene or propene) and C07C1/00,20,24,22.cpc. and membrane (membrane) same (C2 or ethylene or ethane or ethene or methane) and (membrane) same (hydrogen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 16:50
S51	29	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 17:00
S52	27	S51 and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:01
S53	15	S51 and membrane and (glassy polymer or polyimid$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:02
S54	11	S53 and quench$3 and compress$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:03
S55	11	S54 and hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	WITH	ON	2014/09/29 17:05

			DERWENT; IBM_TDB			
S56	6	S55 and membrane same hydrogen same (ethene or ethylene or methane)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:06
S57	1	"7626067".pn. and hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S58	230	"5904880"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S59	3	"5904880".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S60	206	S58 and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S61	179	S58 and membrane same hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:09
S62	179	S58 and membrane same hydrogen and methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:10
S63	384	"5019143" or "452581" or "082481"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:11
S64	370	"5019143" or "452581" or "5082481"	US-PGPUB; USPAT; USOCR;	WITH	ON	2014/09/29 17:11

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S65	322	"5019143" or "5452581" or "5082481"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:11
S66	197	S65 and membrane same hydrogen and methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:11
S67	197	S65 and membrane same hydrogen and methanol and (ethene or ethane or ethylene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:12
S68	128	S67 and "585".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:12
S69	128	S68 and (propylene or propene)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:12
S70	31	pregler.xa. and "585".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 17:15
S71	18	("20050150817" | "20070007175" | "20080154078" | "4257877" | "4423264" | "5026936" | "5371308" | "5523502" | "6049017" | "6090270" | "6646176" | "7128827" | "7161051" | "7431821" | "7601309" | "7728185" | "7732650" | "7741526").PN. OR ("8829259").URPN.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:15
S72	2413	585/639,640,641,638.ccls.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:17
S73	907	S72 and ((ethylene or ethene or ethane) (separat$4 or split$3) and (propylene or propane or propene) (separat$4 or split$3)) or (deethani$6 and depropani$6)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:18

S74	515	S73 and methanol same (propylene or propene or olefin$3)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:19
S75	151	S74 and membrane same hydrogen	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:19
S76	1	"6141988".pn. and propylene	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:53
S77	769	engler.inv.	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:54
S78	1	engler.inv. and methanol same olefin and membrane same hydrogen and (membrane or separat$4 or recover$3) same (propylene or olefin$4)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:54
S79	1	engler.inv. and methanol same olefin and membrane	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:54
S80	113	engler.inv. and membrane	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:55
S81	2	engler.inv. and membrane same hydrogen and (membrane or separat$4 or recover$3) same (propylene or olefin$4)	US-PGPUB; USPAT; USOCR	WITH	ON	2014/09/29 17:55
S82	4	("4499327").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/09/29 18:19
S83	29	"7135604" and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:20
S84	1	"7626067" and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:20
S85	8	S72 and membrane same hydrogen selectiv$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:24
S86	2	"5879431".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	WITH	ON	2014/09/29 18:26

			DERWENT; IBM_TDB			
S87	191	(john senetar).inv.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:27
S88	7	(john senetar).inv. and propylene and methanol and membrane	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 18:27
S89	34	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$).did.	US-PGPUB; USPAT	WITH	ON	2014/09/29 19:43
S90	11	S89 and (ethylene or ethene or hydrocarbon) diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 19:43
S91	204	methanol propylene and (ethylene or ethene or hydrocarbon) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 19:44
S92	19	methanol propylene and (ethylene or ethene) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 19:44
S93	2	methanol and 585/638,640,641,642.ccls. and (ethylene or ethene) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	WITH	ON	2014/09/29 20:01

			DERWENT; IBM_TDB			
S94	5	585/638,640,641,642.ccls. and (ethylene or ethene) adj3 diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:01
S95	158	585/638,640,641,642.ccls. and (ethylene or ethene) diluent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:02
S96	110	585/638,640,641,642.ccls. and (ethylene or ethene) diluent and methanol propylene	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:02
S97	28	585/638,640,641,642.ccls. and (ethylene or ethene or olefin) adj3 diluent and methanol propylene	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:15
S98	0	7626067/pn/	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:21
S99	2	"7626067".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:21
S100	35	(US-20130303819-$ or US-20050065390-$ or US-20040039239-$ or US-20050038304-$ or US-20040147796-$ or US-20040122267-$ or US-20040159233-$ or US-20070197849-$ or US-20050014984-$ or US-20040267075-$ or US-20040267069-$ or US-20040267077-$ or US-20020007101-$ or US-20090187056-$).did. or (US-6544316-$ or US-7115789-$ or US-7626067-$ or US-8338656-$ or US-8704030-$ or US-6264828-$ or US-6141988-$ or US-7371915-$ or US-7396513-$ or US-7495141-$ or US-8829259-$ or US-5523502-$ or US-6069288-$ or US-5927063-$ or US-5904880-$ or US-6121503-$ or US-6884863-$ or US-	US-PGPUB; USPAT	WITH	ON	2014/09/29 20:44

		7135604-$ or US-7005555-$ or US-7414167-$ or US-6444869-$).did.				
S101	4	S100 and permeance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:44
S102	3	S100 and permeance same hydrogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:45
S103	4	S100 and permeance same gpu	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2014/09/29 20:46

EAST Search History (Interference)

<This search history is empty>

9/30/2014 3:52:40 PM
C:\Users\spregler\Documents\EAST\Workspaces\585\Oxygenates\13776362 MTP Membrane.wsp

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CONFIRMATION NO. 7293

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/776,362	02/25/2013	585	1772	976-177

APPLICANTS

INVENTORS

Paul Su, Saratoga, CA;

**** CONTINUING DATA ***************************

This appln claims benefit of 61/644,121 05/08/2012

**** FOREIGN APPLICATIONS ***************************

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03/15/2013

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and Acknowledged /SHARON PREGLER/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	6	29	3

ADDRESS

Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560
UNITED STATES

TITLE

Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

FILING FEE RECEIVED		
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2013-02-25
First Named Inventor	Paul Su
Art Unit	1772
Examiner Name	/Sharon Pregler/
Attorney Docket Number	976-177

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6544316		2003-04-08	Baker, et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.P./

Receipt date: 02/25/2013	Application Number	13776362 - GAU: 1772
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2013-02-25
	First Named Inventor	Paul Su
	Art Unit	
	Examiner Name	
	Attorney Docket Number	976-177

	1		☐

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EXAMINER SIGNATURE

Examiner Signature	/Sharon Pregler/	Date Considered	09/30/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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Receipt date: 02/25/2013	Application Number	13776362 - GAU: 1772
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	2013-02-25
	First Named Inventor	Paul Su
	Art Unit	
	Examiner Name	
	Attorney Docket Number	976-177

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/KB/	Date (YYYY-MM-DD)	2013-02-25
Name/Print	Kathi Bean	Registration Number	36644

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13776362	SU, PAUL
	Examiner	Art Unit
	SHARON PREGLER	1772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/30/2014								
	1	✓								
	2	✓								
	3	✓								
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/776,362	02/25/2013	Paul Su	976-177

CONFIRMATION NO. 7293

26909
Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

PUBLICATION NOTICE

OC000000064984850

Title: Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

Publication No.US-2013-0303819-A1
Publication Date:11/14/2013

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/776,362

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	300		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	29 minus 20 =	* 9	x 40 =	360	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	x 210 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	1090		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/776,362	02/25/2013	1772	812	976-177	29	3

CONFIRMATION NO. 7293

26909
Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

FILING RECEIPT

OC000000059892203

Date Mailed: 03/21/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)
Paul Su, Saratoga, CA;

Applicant(s)
Paul Su, Saratoga, CA;

Assignment For Published Patent Application
Membrane Technology and Research, Inc., Newark, CA

Power of Attorney: The patent practitioners associated with Customer Number 26909

Domestic Priority data as claimed by applicant
This appln claims benefit of 61/644,121 05/08/2012

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/776,362**
Projected Publication Date: 11/14/2013
Non-Publication Request: No
Early Publication Request: No

**** SMALL ENTITY ****

Title

Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

Preliminary Class

585

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/776,362	02/25/2013	Paul Su	976-177

CONFIRMATION NO. 7293

POA ACCEPTANCE LETTER

26909
Membrane Technology and Research, Inc.
39630 Eureka Drive
Newark, CA 94560

OC000000059892510

Date Mailed: 03/21/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/25/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/mkibret/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____

filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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LEGAL NAME OF INVENTOR

Inventor: Paul Su Date (Optional): 2012-02-22

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

MEMBRANE TECHNOLOGY FOR USE IN A METHANOL-TO-PROPYLENE CONVERSION PROCESS

FIELD OF THE INVENTION

[0001] The invention relates to a methanol-to-propylene (MTP) conversion process that utilizes a membrane-based gas separation step to enhance propylene product yield.

BACKGROUND OF THE INVENTION

[0002] Propylene is the second most important feedstock in the petrochemical industry, after ethylene. It is the raw material for a wide variety of products, including polypropylene, which accounts for nearly two-thirds of all demand. In 2008, worldwide sales of propylene reached a value of over 90 billion U.S. dollars, and demand continues to increase.

[0003] There are two traditional routes to propylene production: steam cracking, whereby naphtha or other hydrocarbons are reacted with steam to make light olefins; and fluid catalytic cracking (FCC), which is the refinery operation that breaks down larger hydrocarbons to produce naphtha-weight components for gasoline, as well as olefins and heating oils.

[0004] Propane dehydrogenation (PDH) can also be used to produce propylene. Metathesis of ethylene and butane is yet another route to propylene production.

[0005] There are currently two commercial processes to produce propylene from methanol: the methanol-to-olefin (MTO) process, which produces roughly 50 % ethylene and 50 % propylene, and the methanol-to-propylene (MTP) process, which produces 100 % propylene. PDH and MTO/MTP are "on demand" processes that are cost-effective when oil prices are high and prices of other alternative energy sources such as coal or natural gas are low.

[0006] Methanol-to-propylene (MTP) conversion is an emerging technology that is starting to be commercialized in some areas of the world where feedstocks for conventional processes are in short supply. In the MTP process, methanol is dehydrated to produce dimethyl ether, which is then converted to propylene, with byproducts such as C_2, C_4, C_5, and C_6 olefins, aromatics, and paraffins. After passing through a downstream separation train that usually includes multiple distillation columns, many of these byproducts are recycled to the main MTP reactor to increase propylene production. For example, the condensed overhead from the de-ethanizer column, which typically contains 90 wt% C_2, is sent back to the reactor.

[0007] The non-condensed portion of the de-ethanizer overhead contains inerts such as hydrogen and CO that must be purged from the process. However, the overhead stream also contains valuable C_1 and C_2 hydrocarbons, which are lost from the process in the purge stream, which is typically used as fuel.

[0008] Figure 1A is a detailed schematic for a standard MTP conversion process. The process shown in Figure 1A involves ten principal pieces of equipment (along with various compressors, heat exchangers, separators, etc.), as follows (from left to right on the figure):

- Methanol recovery column, 125;
- Dimethyl ether (DME) reactor, 102;
- Methanol-to-propylene (MTP) reactor, 104;
- Quench column, 106;
- Debutanizer column, 112;
- DME removal system first column, 119;
- DME removal system second column, 120;
- Dehexanizer column, 114;
- De-ethanizer column, 127; and
- Propane-propylene splitter column, 129.

[0009] According to the figure, fresh methanol, 101, from an outside source is routed as part of feed stream, 150, to DME reactor, 102. DME stream, 142, emanating from DME reactor 102, is then split into two streams: Stream, 103, which passes through heat exchange steps to MTP reactor, 104, to better control the reactor temperature; and stream, 143, which mixes with other recycle streams and is then sent to the reactor 104.

[0010] Resulting stream, 105, from MTP reactor 104 is passed to quench column, 106. Resulting stream, 107, from quench column 106 is compressed in compressor, 108. The resulting compressed stream, 109, is separated in separator, 146, into a liquid stream, 110, containing mostly C_3 - C_5 hydrocarbons, and a vapor stream, 111, containing mostly, C_1 - C_4 hydrocarbons.

[0011] Heavier hydrocarbon-containing liquid stream 110 is sent to debutanizer, 112, and separated into a liquid stream, 113, containing mostly C_4 - C_5 and heavier hydrocarbons, and a vapor stream, 117, containing mostly C_3 - C_4 and lighter hydrocarbons.

[0012] Heavier hydrocarbon-containing liquid stream 113 is sent to dehexanizer column, 114, and separated into a liquid stream, 115, containing mostly C_{5+} hydrocarbons, and a vapor stream, 116, containing mostly C_4 - C_5 hydrocarbons. Liquid stream 115 can be sent for use in gasoline.

[0013] Lower hydrocarbon-containing stream 111 and stream 117 from debutanizer 112 are sent for treatment in DME removal system 118, which includes two columns, 119 and 120. Streams 111 and 117 enter first column 119. Stream, 121, containing mostly C_1 - C_3 hydrocarbons, is withdrawn from first column 119 and sent to second column, 120, where it is contacted with methanol, 122, and water, 123. Liquid stream, 124, containing mostly methanol, DME, and water, is withdrawn from the bottom of second column 120. Stream 124 is sent back to the process at position C on the schematic, where it enters the methanol recovery column, 125.

[0014] Vapor stream, 126, containing mostly C_1 - C_3 hydrocarbons, is withdrawn from the top of second column 120 and sent to de-ethanizer 127. Liquid stream, 128, containing mostly C_3 hydrocarbons, is sent to propane-propylene splitter column, 129. Propylene in vapor form is

withdrawn from the top of propylene/propane splitter column 129 and then condensed (condenser not shown) to produce liquid propylene product, 130. Liquid propane, 131, is withdrawn from the bottom of column 129.

[0015] Returning to de-ethanizer column 127: A vapor stream, 132, containing mostly C_1 and C_2, as well as some inerts (typically H_2 and CO) is withdrawn from the top of column 127, then compressed in compressor, 133. The resulting compressed stream, 151, is routed to separator, 147. The non-condensed portion, 134, of compressed stream 151, containing mostly inerts and some residual C_1 and C_2 hydrocarbons, is withdrawn as a purge stream, which can be sent for use as fuel gas, 135.

[0016] The condensed portion, 136, of compressed stream 151, containing mostly C_1 and C_2 hydrocarbons, is split into two portions, one of which is recycled to the de-ethanizer column. The other portion of stream 136 joins stream 116 (containing mostly C_4 - C_5 hydrocarbons) and stream 140 (discussed below) and is sent as hydrocarbon recycle stream, 141, back to the process at position D on the schematic. Hydrocarbon recycle stream 141 joins stream 143, which is then routed to MTP reactor 104.

[0017] Returning to first DME column 119: A liquid stream, 137, containing mostly C_4 hydrocarbons, is withdrawn from the bottom of column 119. A portion, 138, of this stream is sent with propane stream 131 to make liquid petroleum gas (LPG), 139.

[0018] The remaining portion, 140, of stream 137 joins streams 116 and 136 and is sent as hydrocarbon recycle stream, 141, back to the process at position D on the schematic. The recycle stream 141 contains mostly C_2 - C_5 hydrocarbons. As discussed above, this stream joins stream 143 and is routed to MTP reactor 104.

[0019] Returning to quench column 106: The bottoms stream from this column is split into two streams: Stream, 144, is heat-exchanged and joins streams 141 and 143 to be routed to MTP reactor 104; stream 145 joins stream 124 (both of which contain mostly methanol, DME, and

water), to be routed to methanol recovery column 125.

[0020] The bottoms stream from methanol recovery column 125 - which contains mostly water - is split into two streams: Stream 123, is routed to the second column 120 of DME removal system 118 at position B; stream 148 is purged.

[0021] Stream, 149, from the top of methanol recovery column 125, contains mostly methanol and DME, and joins stream 101 to be routed as feed stream 150 to DME reactor 102.

[0022] Figure 1B is a greatly simplified schematic for the MTP conversion process shown in Figure 1A. Referring to the figure, feed stream 150 is routed to reactor train, 160. Referring back to Figure 1A, reactor train 160 consists of dimethyl ether (DME) reactor, 102; MTP reactor, 104; quench column, 106; methanol recovery column, 125; and associated equipment.

[0023] Heavier hydrocarbon-containing liquid stream 110 is sent to debutanizer 112 and separated into liquid stream 113, containing mostly C_4 - C_5 and heavier hydrocarbons, and vapor stream 117, containing mostly C_3 - C_4 and lighter hydrocarbons.

[0024] Heavier hydrocarbon-containing liquid stream 113 is sent to dehexanizer 114 and separated into liquid stream 115, containing mostly C_{5+} hydrocarbons, and vapor stream 116, containing mostly C_4 - C_5 hydrocarbons. As discussed previously, liquid stream 115 can be sent for use in gasoline.

[0025] After passing through the DME removal system, 161 (columns 119 and 120 in Figure 1), stream 117 is sent as vapor stream 126, containing mostly C_1 - C_3 hydrocarbons, to de-ethanizer 127. Liquid stream 128, containing mostly C_3 hydrocarbons, is sent to propylene/propane splitter column 129. Propylene in vapor form is withdrawn from the top of propylene/propane splitter column 129 and condensed (condenser not shown) to produce liquid propylene product 130. Liquid propane 131 is withdrawn from the bottom of column 129.

[0026] Vapor stream 132, containing mostly C_1 and C_2, as well as some inerts, is withdrawn from the top of column 127, then compressed and condensed (compressor and condenser not shown in Figure 1B). The non-condensed portion, 134, contains mostly inerts and some residual C_1 and C_2 hydrocarbons and is withdrawn as a purge stream, which can be sent for use as fuel gas, as discussed above.

[0027] The condensed portion, 136, containing mostly C_1 and C_2 hydrocarbons, is split into two portions, 136a and 136b. Portion 136a is recycled to the de-ethanizer column. Referring back to Figure 1A, portion 136b joins streams 116 and 140 and is sent as hydrocarbon recycle stream 141 back to the process at position D on the schematic. Hydrocarbon recycle stream 141 joins stream 143, which is then routed to MTP reactor 104.

SUMMARY OF THE INVENTION

[0028] The invention is a methanol-to-propylene (MTP) conversion process that utilizes a membrane separation step. Depending on the type of membranes used, either the residue stream or the permeate stream may be recycled back to various positions upstream in the process, thereby reducing feedstock losses and increasing propylene product yield.

[0029] A basic process of the invention utilizes membranes that are selective to hydrogen over C_2 hydrocarbons in the membrane separation step. The membrane is typically also selective for carbon oxides (*i.e.*, carbon monoxide and carbon dioxide) over C_2 hydrocarbons.

[0030] This process embodiment comprises the following steps:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, carbon dioxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream as a feed stream across the feed side;

(e) withdrawing from the permeate side a permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the feed side a residue stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the residue stream as a recycle stream back to step (a).

[0031] The membrane residue stream may be recirculated at any convenient point within the reaction and separation sub-steps that make up step (a) - typically to a point in the MTP conversion operation where the pressure is at least 1 bar less than the feed stream pressure, to account for pressure drop across the membrane. In one embodiment, the membrane residue stream is recycled back to a compressor located downstream of a de-ethanizer column. Alternatively, the residue stream may be recycled back to a compressor downstream of a quench column, or directly back to a methanol-to-propylene reactor.

[0032] In accordance with this embodiment, the membrane preferably comprises a glassy polymer. The membrane preferably has a selectivity for hydrogen over ethylene of at least 10 and, more preferably, at least 15 or 20. The membrane preferably has a hydrogen permeance of at least about 500 gpu and, more preferably, at least about 1,000 gpu.

[0033] An alternative process embodiment of the invention utilizes membranes that are selective to C_2 hydrocarbons over hydrogen. The membrane is typically also selective for C_2 hydrocarbons over carbon oxides.

[0034] A basic embodiment of this process comprises the following steps:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, carbon dioxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to C_2 hydrocarbons over hydrogen;

(d) passing the gas stream across the feed side;

(e) withdrawing from the feed side a residue stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the permeate side a permeate stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the permeate stream as a recycle stream back to step (a).

[0035] The permeate stream may be recycled back to a compressor downstream of a quench column. Alternatively, the permeate stream may be recycled directly back to a methanol-to-propylene reactor, or to any other point in the MTP conversion operation where the pressure is no more than 7 bar gauge (bar g).

[0036] In accordance with this embodiment, the membrane preferably comprises a rubbery polymer. The membrane preferably has a selectivity for ethylene over hydrogen of at least 4 and, more preferably, at least 5, 8, or even 10. The membrane preferably has a C_2 hydrocarbon permeance of at least about 400 gpu and, more preferably, at least about 800 gpu.

[0037] A specific embodiment of the invention utilizes two membrane separation steps, where the first membrane separation step utilizes membranes that are selective to hydrogen over C_2 hydrocarbons, and the second membrane separation step utilizes membranes that are selective to C_2 hydrocarbons over hydrogen. The first membrane is typically also selective for carbon oxides over C_2 hydrocarbons, and the second membrane, for C_2 hydrocarbons over carbon oxides.

[0038] This process embodiment comprises the following basic steps:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, carbon dioxide, and C_1 and C_2 hydrocarbons;

(c) providing a first membrane having a first feed side and a first permeate side, wherein the first membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream across the first feed side;

(e) withdrawing from the first permeate side a first permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the first feed side a first residue stream that is enriched in C_2 hydrocarbons relative to the gas stream;

(g) providing a second membrane having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen;

(h) passing the first residue stream across the second feed side;

(i) withdrawing from the second feed side a second residue stream that is depleted in C_2 hydrocarbons relative to the first residue stream;

(j) withdrawing from the second permeate side a second permeate stream that is enriched in C_2 hydrocarbons relative to the first residue stream; and

(k) passing the second permeate stream as a recycle stream back to step (a).

[0039] The second permeate stream may be recycled back to a compressor downstream of a quench column. Alternatively, the second permeate stream may be recycled directly to a methanol-to-propylene reactor, or to any other point in the MTP conversion operation, preferably where the pressure is no more than about 7 bar g.

[0040] In accordance with this process embodiment, the first membrane preferably comprises a glassy polymer. The first membrane preferably has a selectivity for hydrogen over ethylene of at least 10 and, more preferably, at least 15 or 20. The first membrane preferably has a hydrogen permeance of at least about 500 gpu and, more preferably, at least about 1,000 gpu.

[0041] The second membrane preferably comprises a rubbery polymer. The second membrane preferably has a selectivity for ethylene over hydrogen of at least 4 and, more preferably, at least 5, 8, or even 10. The second membrane preferably has a C_2 hydrocarbon permeance of at least about 400 gpu and, more preferably, at least about 800 gpu.

[0042] The process of the invention results in increased recycle of C_2 hydrocarbons to the MTP reactor, thereby increasing product yield and reducing raw material loss.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] Figure 1A is a detailed schematic for a standard MTP conversion process (not in accordance with the invention).

[0044] Figure 1B is a greatly simplified schematic for the MTP conversion process shown in Figure 1A (not in accordance with the invention).

[0045] Figure 2A is a basic process schematic for an MTP conversion process in accordance with the invention, where a stream containing mostly inerts and C_1 and C_2 hydrocarbons is withdrawn from the top of the de-ethanizer column and processed in a membrane separation unit containing membranes that are selective to hydrogen over C_1 and C_2 hydrocarbons.

[0046] Figure 2B is a detailed schematic for the MTP conversion process shown in Figure 2A.

[0047] Figure 3 is a basic process schematic for an MTP conversion process in accordance with an alternative embodiment of the invention, where a stream containing mostly inerts and C_1 and C_2 hydrocarbons is withdrawn from the top of the de-ethanizer column and processed in a membrane separation unit containing membranes that are selective to C_1 and C_2 hydrocarbons over hydrogen.

[0048] Figure 4 is process schematic for an MTP conversion process in accordance with a specific embodiment of the invention, where a stream containing mostly inerts and C_1 and C_2 hydrocarbons is withdrawn from the top of the de-ethanizer column and processed in a first membrane separation unit containing membranes that are selective to hydrogen over C_1 and C_2 hydrocarbons, followed by processing of the residue stream from the first membrane unit in a second membrane unit containing membranes that are selective to C_1 and C_2 hydrocarbons over hydrogen.

DETAILED DESCRIPTION OF THE INVENTION

[0049] The invention is a methanol-to-propylene (MTP) conversion process that utilizes a membrane separation step to increase the recycle of C_2 hydrocarbons back to the MTP reactor, thereby increasing propylene product yield and reducing raw material loss.

[0050] A basic process schematic for an MTP conversion process in accordance with the invention is shown in Figure 2A; a detailed schematic is shown in Figure 2B (reference numerals on Figure 2B correspond to reference numerals on Figure 1A). The basic process is the same as that shown in Figures 1A and 1B, except that stream 134, originating from de-ethanizer column 127, is processed in a membrane separation unit, 251, containing membranes, 252, that are selective to hydrogen over C_2 hydrocarbons.

[0051] Membranes for use in the embodiment of the invention shown in Figures 2A and 2B (which will be described in the Examples section) may comprise any polymer that will preferentially permeate hydrogen over C_2 hydrocarbons. Typically, the membrane is also selective for carbon oxides (*i.e.*, carbon monoxide and carbon dioxide) over C_2 hydrocarbons. The membrane preferably has a selectivity for hydrogen over ethylene of at least 10 and, more preferably, at least 15 or 20. The membrane also preferably has a hydrogen permeance of at least about 500 gpu and, more preferably, at least about 1,000 gpu.

[0052] Preferred membrane materials are "glassy" polymers, such as, for example and without limitation, polyamides, polyimides, polysulfones, polyvinyl alcohol, polypropylene oxide, cellulose derivatives, polyvinylidene fluoride, and polymers having repeating units of fluorinated dioxoles, fluorinated dioxolanes, and fluorinated cyclically polymerizable alkyl ethers.

[0053] Particularly preferred membranes for use in the process of the invention have selective layers made from a hydrophobic fluorinated glassy polymer or copolymer. This polymer determines the membrane selectivity. Commercially available fluorinated polymers/ copolymers that are suitable for use in the process of the present invention include Hyflon® AD (Solvay

Solexis, Inc., Thorofare, NJ); Cytop® (Asahi Glass Company, Tokyo, Japan); and Teflon® AF (DuPont, Wilmington, DE). Uses of such materials are described in U.S Patent 6,544,316.

[0054] The polymer chosen for the selective layer can be used to form films or membranes by any convenient technique known in the art, and may take diverse forms. The membrane may take the form of a homogeneous film, an integral asymmetric membrane, a multilayer composite membrane, a membrane incorporating a gel or liquid layer or particulates, or any other form known in the art.

[0055] Because the polymers are glassy and rigid, an unsupported film, tube, or fiber of the polymer is usable as a single-layer membrane. However, single-layer films will normally be too thick to yield acceptable transmembrane flux however, and, in practice, the separation membrane usually comprises a very thin selective layer that forms part of a thicker structure, such as an integral asymmetric membrane or a composite membrane.

[0056] The preferred form is a composite membrane. Modern composite membranes typically comprise a highly permeable, but relatively non-selective, support membrane that provides mechanical strength, coated with a thin selective layer of another material that is primarily responsible for the separation properties. Typically, but not necessarily, such a composite membrane is made by solution-casting the support membrane, then solution-coating the selective layer. Preparation techniques for making composite membranes of this type are well known.

[0057] The membranes may be manufactured as flat sheets or as fibers and housed in any convenient module form, including spiral-wound modules, plate-and-frame modules, and potted hollow fiber modules. The making of all these types of membranes and modules is well-known in the art. Flat-sheet membranes in spiral-wound modules is the most preferred choice.

[0058] Membrane unit 251 may contain a single membrane module or bank of membrane modules or an array of modules. A single-stage membrane separation operation is adequate for many applications. If the permeate stream requires further purification, it may be passed to a second bank of membrane modules for a second processing step. If the residue stream requires further concentration, it may be passed to a second bank of membrane modules for a second-stage treatment. Such multi-stage or multi-step processes, and variants thereof, will be familiar to those of skill in the art, who will appreciate that the membrane separation step may be configured in many possible ways, including single-stage, multi-stage, multi-step, or more complicated arrays of two or more units in serial or cascade arrangements.

[0059] Stream 134, which is at high pressure after being compressed in compressor 133 (shown in Figure 2B), flows as a feed stream 250 across the feed surface of membrane 252. The permeate side of the membrane is maintained at lower pressure to provide a driving force for transmembrane permeation. Hydrogen and carbon monoxide permeate the membrane preferentially, resulting in hydrocarbon-enriched residue stream, 253, and hydrocarbon-depleted permeate stream, 255. Typically, the feed side is maintained at a pressure within the range of about 20 bar g to about 40 bar g. The permeate side is typically maintained at a pressure within the range of about 1 bar g to about 25 bar g; preferably, the permeate side is maintained at a pressure of 7 bar g or less.

[0060] As is familiar to those of skill in the art, the separation performance achieved by the membrane depends on such factors as the membrane selectivity, the pressure ratio between feed and permeate sides, and the membrane area. The transmembrane flux depends on the permeability of the membrane material, the pressure difference across the membrane, and the membrane thickness.

[0061] Hydrocarbon-depleted permeate stream 255 is withdrawn from the permeate side of the membrane unit 251. Stream 255 - the major component of which is now the combined contaminants hydrogen and carbon monoxide - can either be flared or sent for use as fuel gas.

[0062] Hydrocarbon-enriched membrane residue stream 253 is withdrawn from the feed side of the membrane unit 251. In the embodiment shown in Figures 2A and 2B, membrane residue stream 253 is combined with stream 132 and routed as combined stream 254 back to the process upstream of compressor 133 (shown in Figure 2B), from where it is passed as compressed stream 151 to condenser 147, and thence to recovery via streams 136 and 141 at position D on Figure 2B.

[0063] Alternatively, residue stream 253 can be routed (without the need for compression) back to the process at one (or both) of two positions:

- To position E: After quench column 106 and upstream of main compressor 108.
- To position F: Directly back to MTP reactor 104.

[0064] As yet another option, membrane residue stream 253 can be routed back to any point in the MTP conversion operation where the pressure is at least 1 bar less than the feed stream pressure, to account for pressure drop across the membrane.

[0065] A basic process schematic for an MTP conversion process in accordance with an alternative embodiment of the invention is shown in Figure 3. The basic process is the same as that shown in Figures 1A and 1B, except that stream 134, originating from de-ethanizer column 127, is processed in a membrane separation unit, 351, containing membranes, 352, that are selective to C_2 hydrocarbons over hydrogen.

[0066] Membranes for use in the embodiment of the invention shown in Figure 3 may comprise any polymer that will preferentially permeate C_2 hydrocarbons over hydrogen. The membrane preferably has a selectivity for ethylene over hydrogen of at least 4 and, more preferably, at least 5, 8, or even 10. The membrane also preferably has a C_2 hydrocarbon permeance of at least about 400 gpu and, more preferably, at least about 800 gpu.

[0067] In this process embodiment, the membrane 352 is typically made from an elastomeric or "rubbery" polymer. Examples of polymers that can be used to make elastomeric membranes include, but are not limited to, nitrile rubber, neoprene, polydimethylsiloxane (also known as

PDMS or silicone rubber), chlorosulfonated polyethylene, polysilicone-carbonate copolymers, fluoroelastomers, plasticized polyvinylchloride, polyurethane, cis-polybutadiene, cis-polyisoprene, poly(butene-1), polystyrene-butadiene copolymers, styrene/butadiene/styrene block copolymers, styrene/ethylene/butylene block copolymers, thermoplastic polyolefin elastomers, and block copolymers of polyethers, polyamides, and polyesters. Membranes where the selective layer comprises PDMS are particularly preferred.

[0068] Membrane modules and configurations are as discussed above with respect to the process embodiment shown in Figures 2A and 2B.

[0069] Feed stream 134, which is at high pressure after being compressed in compressor 133 (shown in Figure 1A), flows as a feed stream across the feed surface of membrane 352. The permeate side of the membrane is maintained at lower pressure to provide a driving force for transmembrane permeation. C_1 and C_2 hydrocarbons permeate the membrane preferentially, resulting in hydrocarbon-enriched permeate stream, 355, and hydrocarbon-depleted residue stream, 353. Typically, the feed side is maintained at a pressure within the range of about 20 bar g to about 40 bar g. The permeate side is typically maintained at a pressure within the range of about 1 bar g to about 25 bar g; preferably, the permeate side is maintained at a pressure of 7 bar g or less.

[0070] Hydrocarbon-depleted membrane residue stream 353 is withdrawn from the feed side of the membrane unit 351. Stream 353 - the major component of which is now the combined contaminants hydrogen and carbon monoxide - can either be flared or sent for use as fuel gas.

[0071] Hydrocarbon-enriched permeate stream 355 is withdrawn from the permeate side of the membrane unit 351. Referring to Figure 1A, permeate stream 355 can then be routed back to the process at one (or both) of two positions:

- To position E: After quench column 106 and upstream of main compressor 108.
- To position F: Directly back to MTP reactor 104.

[0072] As yet another option, permeate stream 355 can be routed back to any point in the MTP conversion operation where the pressure is no more than 7 bar g.

[0073] A process schematic for an MTP conversion process in accordance with a specific embodiment of the invention is shown in Figure 4. The basic process is the same as that shown in Figures 1A and 1B, except that stream 134, originating from de-ethanizer column 127, is processed in a first membrane separation unit, 451, containing membranes, 452, that are selective to hydrogen over C_2 hydrocarbons, followed by processing of the residue stream, 453, from the first membrane unit in a second membrane unit, 461, containing membranes, 462, that are selective to C_2 hydrocarbons over hydrogen.

[0074] Stream 134, which is at high pressure after being compressed in compressor 133 (shown in Figure 1A), flows as a feed stream across the feed surface of membrane 452. The feed stream is typically heated (heating unit not shown) before being sent to membrane unit 451. The membranes 452 are typically glassy polymeric membranes, as described above with respect to membranes 252 in Figure 2A. Membrane modules and configurations are also as discussed above with respect to the process embodiment shown in Figures 2A and 2B.

[0075] As discussed above, the permeate side of the membrane is maintained at lower pressure to provide a driving force for transmembrane permeation. Hydrogen and carbon monoxide permeate the membrane preferentially, resulting in hydrocarbon-enriched residue stream, 453, and hydrocarbon-depleted permeate stream, 455. Typically, the feed side is maintained at a pressure within the range of about 20 bar g to about 40 bar g. The permeate side is typically maintained at a pressure within the range of about 1 bar g to about 25 bar g; preferably, the permeate side is maintained at a pressure of 7 bar g or less.

[0076] Hydrocarbon-depleted permeate stream 455 is withdrawn from the permeate side of first membrane unit 451. Stream 455 - the major component of which is now the combined contaminants hydrogen and carbon monoxide - can either be flared or sent for use as fuel gas.

[0077] Hydrocarbon-depleted membrane residue stream 453 is withdrawn from the feed side of the membrane unit 451, and is routed as a feed stream to second membrane unit 461 containing membranes 462 that are selective to C_1 and C_2 hydrocarbons over hydrogen. Membranes 462 are typically rubbery polymeric membranes, as described above with respect to membranes 352 in Figure 3. Membrane modules and configurations are again as discussed above with respect to the process embodiment shown in Figures 2A and 2B.

[0078] First membrane residue stream 453, which is still at high pressure, flows as a feed stream, 460, across the feed surface of second membrane 452. The permeate side of the membrane is maintained at lower pressure to provide a driving force for transmembrane permeation. C_1 and C_2 hydrocarbons permeate the membrane preferentially, resulting in hydrocarbon-enriched permeate stream, 465, and hydrocarbon-depleted residue stream, 463. Typically, the feed side is maintained at a pressure within the range of about 20 bar g to about 40 bar g. The permeate side is typically maintained at a pressure within the range of about 1 bar g to about 25 bar g; preferably, the permeate side is maintained at a pressure of 7 bar g or less.

[0079] Hydrocarbon-depleted membrane residue stream 463 is withdrawn from the feed side of second membrane unit 461. Stream 463 - the major component of which is now the combined contaminants hydrogen and carbon monoxide - can either be flared or sent for use as fuel gas.

[0080] Hydrocarbon-enriched permeate stream 465 is withdrawn from the permeate side of the second membrane unit 461. Second permeate stream 465 can then be routed back to the process at one (or both) of position E or position F, as discussed above with respect to the process embodiment shown in Figure 3.

[0081] As yet another option, second permeate stream 465 can be routed back to any point in the MTP conversion operation where the pressure is no more than 7 bar g.

[0082] The invention is now further described by the following examples, which are intended to be illustrative of the invention, but are not intended to limit the scope or underlying principles in any way.

EXAMPLES

Example 1. Comparative Example - Conventional MTP Process (not in accordance with the invention)

[0083] The calculations that follow were performed using a computer process simulation program (ChemCad 6.3.2, ChemStations, Houston, TX) which was modified with differential element subroutines for the membrane separation steps (as applicable).

[0084] The following calculation was performed according to the process schematic illustrated in Figure 1A, for a conventional MTP process. The plant was assumed to be processing 4,400 tons of methanol per day, and producing 1,370 tons of propylene per day.

[0085] As shown in Figure 1A, the portion of the lights stream from the de-ethanizer overhead that is to be purged to the fuel line is sent first to compression, 133, cooling, and phase separation, 147, to separate out some of the ethylene in stream 136. Stream 135 is sent as purge to the fuel line. Results of the calculation are presented in Table 1.

Table 1. Conventional MTP Process (not in accordance with the invention)

Stream:	**Flare / Fuel Gas (135)**	Recycle Stream (136)
Mass Flow (kmol/h)	**79**	390
Mass Flow (kg/h)	**1,395**	9,935
Temp. (°C)	**- 48**	- 48
Pressure (bar g)	**34**	34
Methane (mol%)	**39.8**	17.9
Ethylene (mol%)	**38.6**	80.5
Carbon Monoxide (mol%)	**0.16**	0.03
Hydrogen (mol%)	**21.5**	1.5
Methane (kg/h)	**503**	1,121
Ethylene (kg/h)	**854**	8,800
Carbon Monoxide (kg/h)	**3.5**	3.1
Hydrogen (kg/h)	**34.1**	12.1

[0086] As can be seen from Table 1, the purge stream, 135, still contains about 854 kg/h ethylene. It would be therefore be helpful to have a process that recycles more of the ethylene back to the MTP process.

Example 2. Process of the Invention, with One Membrane Separation Step, and Recycle of C_1 and C_2 Hydrocarbons to the De-ethanizer

[0087] The following calculation was performed according to the process schematic illustrated in Figure 2B, where a stream, 132, containing mostly inerts and C_1 and C_2 hydrocarbons is withdrawn from the top of the de-ethanizer column 127 and processed as feed stream 250 in membrane separation unit 251 containing membranes 252 that are selective to hydrogen over C_1 and C_2 hydrocarbons. Hydrocarbon-enriched membrane residue stream 253 is then combined with stream 132 and routed as

combined stream 254 to the process upstream of compressor 133, from where it is passed as compressed stream 151 via condenser 147, and streams 136 and 141 to hydrocarbon recycle at position D.

[0088] The membrane 252 was assumed to have a hydrogen / ethylene selectivity of 14.3 and a hydrogen permeance of 672 gpu. Membrane area was assumed to be 76 m^2. Results of the calculation are presented in Table 2.

Table 2. Process of the Invention, with One Membrane Separation Step, and Recycle of C_1 and C_2 Hydrocarbons to the De-ethanizer

Stream:	Membrane Feed (250)	**Membrane Permeate / Fuel Gas (255)**	Membrane Residue / Recycle Stream (253)
Mass Flow (kmol/h)	168	**33.5**	134
Mass Flow (kg/h)	3,080	**364**	2,716
Temp. (°C)	- 10	**- 10**	- 10
Pressure (bar g)	34	**1**	34
Methane (mol%)	45.7	**29.5**	49.7
Ethylene (mol%)	38.0	**17.7**	43.1
Carbon Monoxide (mol%)	0.16	**0.3**	0.12
Hydrogen (mol%)	16.2	**52.4**	7.1
Methane (kg/h)	1,229	**159**	1,071
Ethylene (kg/h)	1,788	**167**	1,622
Carbon Monoxide (kg/h)	7.5	**3.0**	4.6
Hydrogen (kg/h)	54.7	**35.4**	19.3

[0089] As can be seen from Table 2, flare / fuel gas stream 255 contains 167 kg/h ethylene, as opposed to 854 kg/h ethylene for the conventional MTP process - a reduction of about 80 %.

Example 3. Process of the Invention, with Two Membrane Separation Steps, and Recycle of C_1 and C_2 Hydrocarbons to Either the Compressor Downstream of the Quench Column, or to the MTP Reactor

[0090] The following calculation was performed according to the process schematic illustrated in Figure 4, where a stream 134 containing mostly inerts and C_1 and C_2 hydrocarbons is withdrawn from the top of the de-ethanizer column 127 and processed in a first membrane separation unit, 451, containing membranes, 452, that are selective to hydrogen over C_1 and C_2 hydrocarbons, followed by processing of the residue stream, 453, from the first membrane unit in a second membrane unit, 461, containing membranes, 462, that are selective to C_1 and C_2 hydrocarbons over hydrogen.

[0091] Hydrocarbon-enriched second membrane permeate stream 465 can then be recycled back to the process at one (or both) of two positions:

- To position E: After quench column 106 and upstream of main compressor 108.
- To position F: Directly back to MTP reactor 104.

[0092] First membrane 452 was assumed to have a hydrogen / ethylene selectivity of 14.3 and a hydrogen permeance of 672 gpu. First membrane area was assumed to be 55 m^2. Second membrane 462 was assumed to have an ethylene / hydrogen selectivity of 4.3 and a C_2 hydrocarbon permeance of 456 gpu. Second membrane area was assumed to be 48 m^2. Results of the calculation are presented in Table 3.

Table 3. Process of the Invention, with Two Membrane Separation Steps, and Recycle of C_1 and C_2 Hydrocarbons to Either the Compressor Downstream of the Quench Column, or to the MTP Reactor

Stream:	First Membrane Feed (134)	**First Membrane Permeate (455)**	First Membrane Residue (453)	**Second Membrane Residue / Fuel Gas (463)**	Second Membrane Permeate / Recycle Stream (465)
Mass Flow (kmol/h)	**79**	**25.4**	53.5	**9.2**	44.3
Mass Flow (kg/h)	**1,395**	**367**	1,129	**143**	986
Temp. (°C)	**- 48**	**- 10**	- 10	**- 52**	- 31
Pressure (bar g)	**34**	**1**	34	**34**	2.1
Methane (mol%)	**39.8**	**25.9**	46.4	**75.9**	40.2
Ethylene (mol%)	**38.6**	**18.4**	48.2	**10.7**	55.9
Carbon Monoxide (mol%)	**0.16**	**0.28**	0.10	**0.24**	0.07
Hydrogen (mol%)	**21.5**	**55.4**	5.4	**12.1**	3.7
Methane (kg/h)	**503**	**105**	398	**112**	286
Ethylene (kg/h)	**854**	**131**	723	**27.7**	696
Carbon Monoxide (kg/h)	**3.5**	**2.0**	1.5	**0.6**	0.9
Hydrogen (kg/h)	**34.1**	**28.3**	5.8	**2.4**	2.3

[0093] As can be seen from Table 3, together, first membrane permeate stream 455 and flare / fuel gas

stream 463 contain a total of 158.7 kg/h ethylene, as opposed to 854 kg/h ethylene for the conventional MTP process - a reduction of about 81 %.

We claim:

1. A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream as a feed stream across the feed side;

(e) withdrawing from the permeate side a permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the feed side a residue stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the residue stream as a recycle stream back to step (a).

2. A process in accordance with Claim 1, wherein the residue stream is recycled back to a point of the operation where the pressure is at least 1 bar less than the feed stream pressure.

3. A process in accordance with Claim 1, wherein the residue stream is recycled back to a compressor located downstream of a de-ethanizer column.

4. A process in accordance with Claim 1, wherein the residue stream is recycled back to a compressor downstream of a quench column.

5. A process in accordance with Claim 1, wherein the residue stream is recycled back to a methanol-to-propylene reactor.

6. A process in accordance with Claim 1, wherein the membrane comprises a glassy polymer.

7. A process in accordance with Claim 1, wherein the membrane has a selectivity for hydrogen over ethylene of at least 10.

8. A process in accordance with Claim 1, wherein the membrane has a hydrogen permeance of at least about 500 gpu.

9. A process in accordance with Claim 1, wherein the membrane is also selective for carbon oxides over C_2 hydrocarbons.

10. A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a membrane having a feed side and a permeate side, wherein the membrane is selective to C_2 hydrocarbons over hydrogen;

(d) passing the gas stream across the feed side;

(e) withdrawing from the feed side a residue stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the permeate side a permeate stream that is enriched in C_2 hydrocarbons relative to the gas stream; and

(g) passing the permeate stream as a recycle stream back to step (a).

11. A process in accordance with Claim 10, wherein the permeate stream is recycled back to a point of the operation where the pressure is no more than 7 bar g.

12. A process in accordance with Claim 10, wherein the permeate stream is recycled back to a compressor downstream of a quench column.

13. A process in accordance with Claim 10, wherein the permeate stream is recycled back to a methanol-to-propylene reactor.

14. A process in accordance with Claim 10, wherein the membrane comprises a rubbery polymer.

15. A process in accordance with Claim 10, wherein the membrane has a selectivity for ethylene over hydrogen of at least 4.

16. A process in accordance with Claim 10, wherein the membrane has a C_2 hydrocarbon permeance of at least about 400 gpu.

17. A process in accordance with Claim 10, wherein the membrane is also selective for carbon oxides over C_2 hydrocarbons.

18. A methanol-to-propylene conversion process, comprising:

(a) performing an operation to convert methanol to propylene, said operation including at least one reaction step and at least one propylene recovery step;

(b) withdrawing from the operation a gas stream comprising hydrogen, carbon monoxide, and C_1 and C_2 hydrocarbons;

(c) providing a first membrane having a first feed side and a first permeate side, wherein the first membrane is selective to hydrogen over C_2 hydrocarbons;

(d) passing the gas stream across the first feed side;

(e) withdrawing from the first permeate side a first permeate stream that is depleted in C_2 hydrocarbons relative to the gas stream;

(f) withdrawing from the first feed side a first residue stream that is enriched in C_2 hydrocarbons relative to the gas stream;

(g) providing a second membrane having a second feed side and a second permeate side, wherein the second membrane is selective to C_2 hydrocarbons over hydrogen;

(h) passing the first residue stream across the second feed side;

(i) withdrawing from the second feed side a second residue stream that is depleted in C_2 hydrocarbons relative to the first residue stream;

(j) withdrawing from the second permeate side a second permeate stream that is enriched in C_2 hydrocarbons relative to the first residue stream; and

(k) passing the second permeate stream as a recycle stream back to step (a).

19. A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a point of the operation where the pressure is no more than 7 bar g.

20. A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a compressor downstream of a quench column.

21. A process in accordance with Claim 18, wherein the second permeate stream is recycled back to a methanol-to-propylene reactor.

22. A process in accordance with Claim 18, wherein the first membrane comprises a glassy polymer.

23. A process in accordance with Claim 18, wherein the first membrane has a selectivity for hydrogen over ethylene of at least 10.

24. A process in accordance with Claim 18, wherein the first membrane has a hydrogen permeance of at least about 500 gpu.

25. A process in accordance with Claim 18, wherein the second membrane comprises a rubbery polymer.

26. A process in accordance with Claim 18, wherein the second membrane has a selectivity for ethylene over hydrogen of at least 4.

27. A process in accordance with Claim 18, wherein the second membrane has a C_2 hydrocarbon permeance of at least about 400 gpu.

28. A process in accordance with Claim 18, wherein the first membrane is also selective for carbon oxides over C_2 hydrocarbons.

29. A process in accordance with Claim 18, wherein the second membrane is also selective for C_2 hydrocarbons over carbon oxides.

ABSTRACT OF THE DISCLOSURE

Disclosed herein is a methanol-to-propylene (MTP) conversion process that utilizes a membrane separation step to increase the recycle of C_2 hydrocarbons back to the MTP reactor, thereby increasing propylene product yield and reducing raw material loss.

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2013-02-25
	First Named Inventor	Paul Su
	Art Unit	
	Examiner Name	
	Attorney Docket Number	976-177

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2013-02-25
First Named Inventor	Paul Su
Art Unit	
Examiner Name	
Attorney Docket Number	976-177

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/KB/	Date (YYYY-MM-DD)	2013-02-25
Name/Print	Kathi Bean	Registration Number	36644

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S DEPARTMENT OF COMMERCE

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 26909

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒ The address associated with Customer Number: 26909

OR

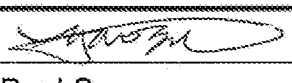
☐	Firm or Individual Name			
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: Membrane Technology and Research, Inc.

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	2012-02-22
Name	Paul Su	Telephone	650-328-2228
Title	Process Engineer		

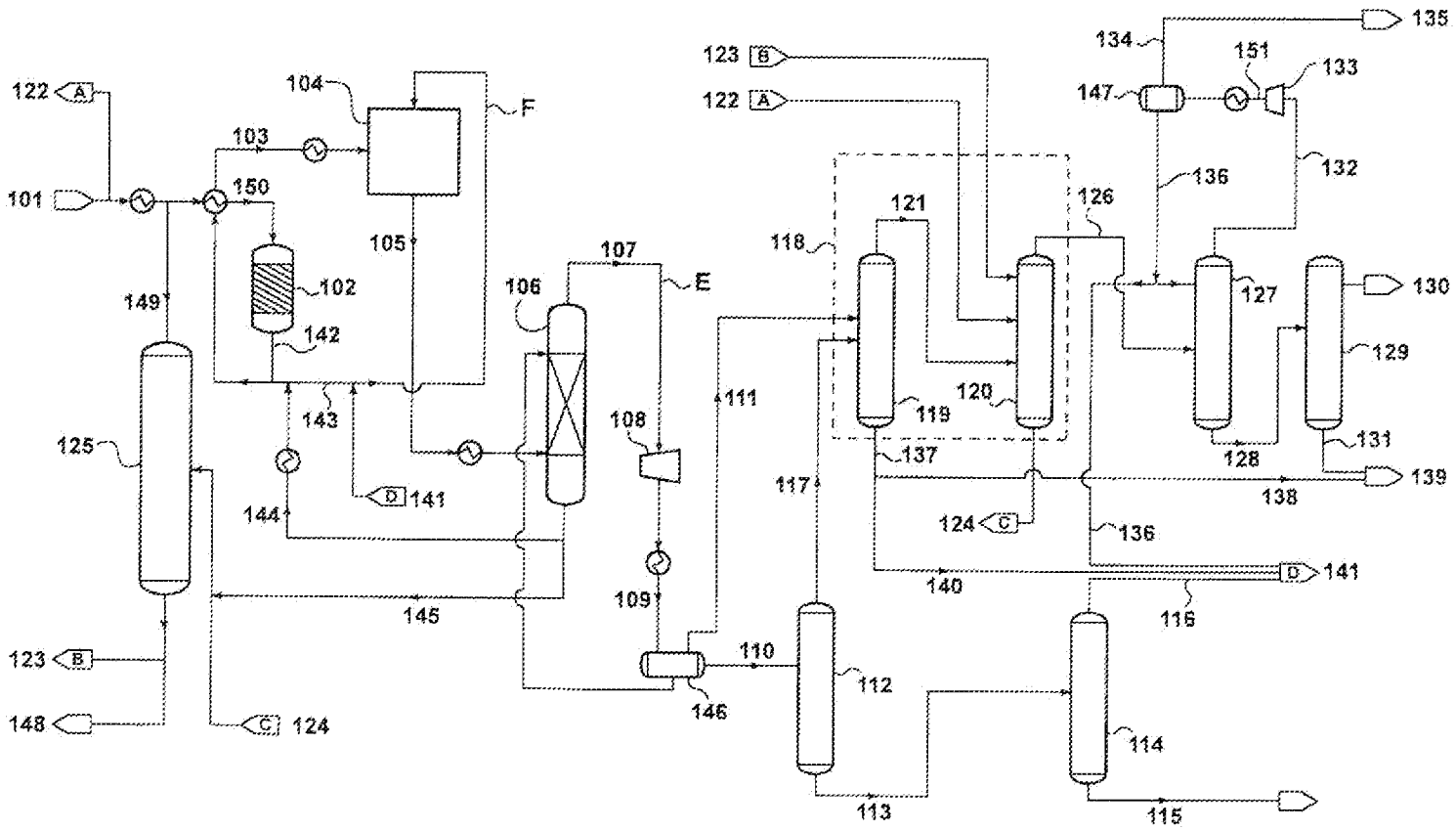


FIG. 1A
(not in accordance with invention)

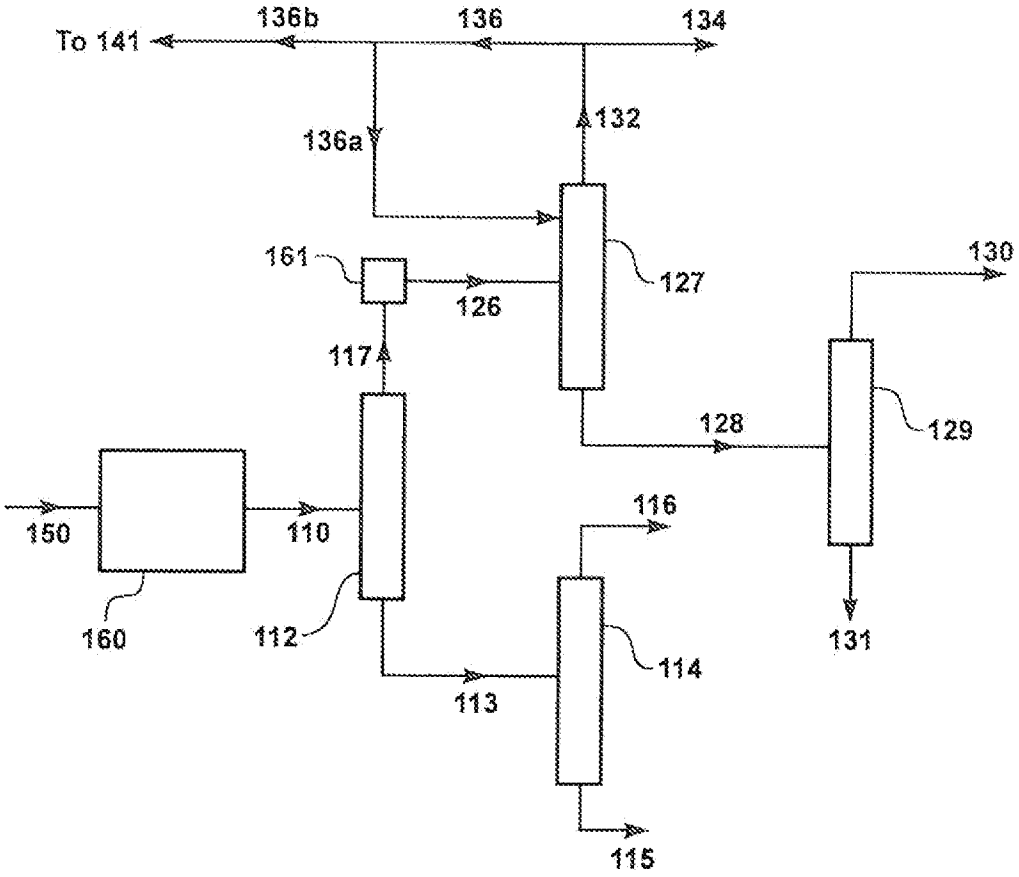


FIG. 1B
(not in accordance with invention)

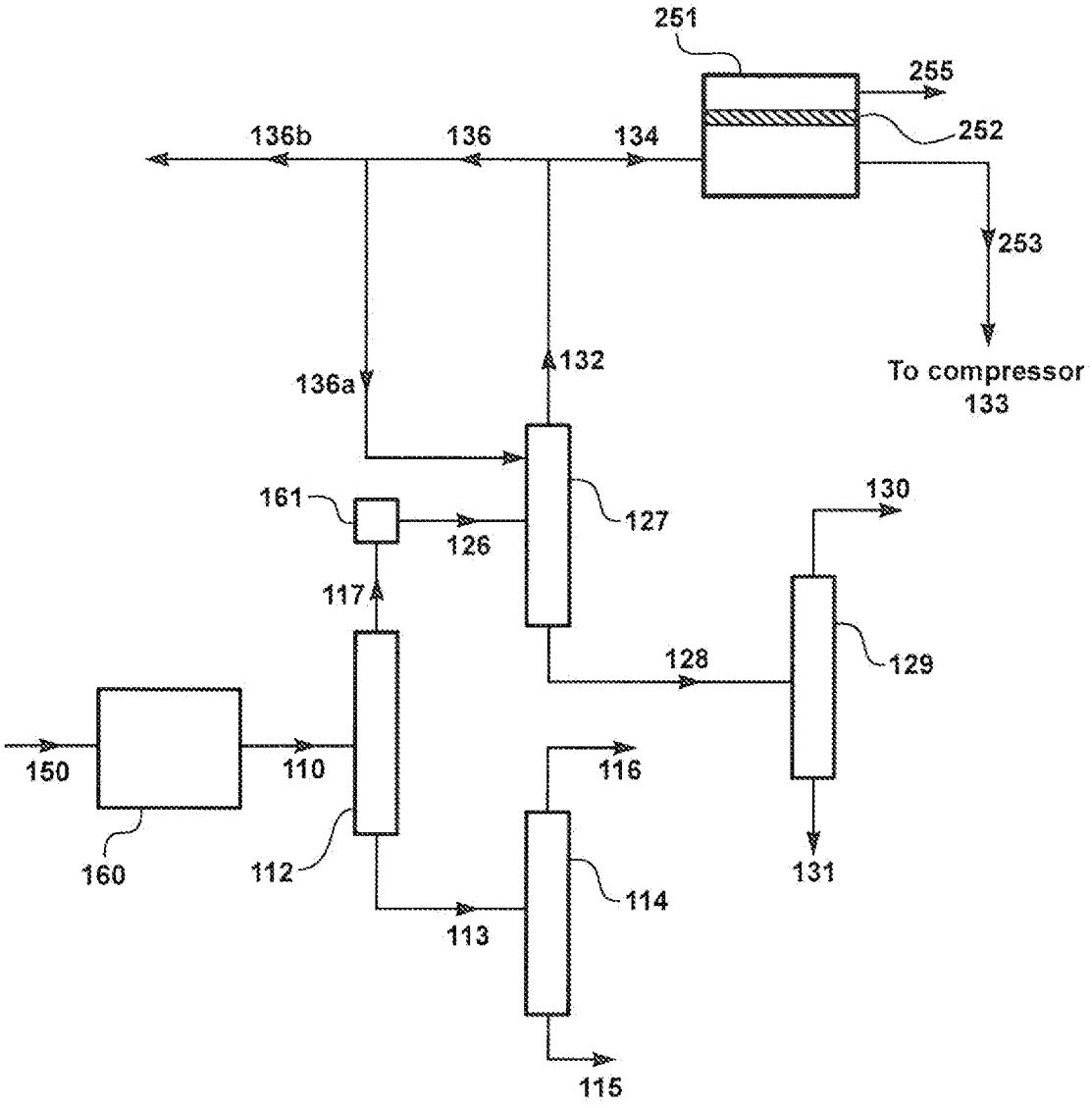

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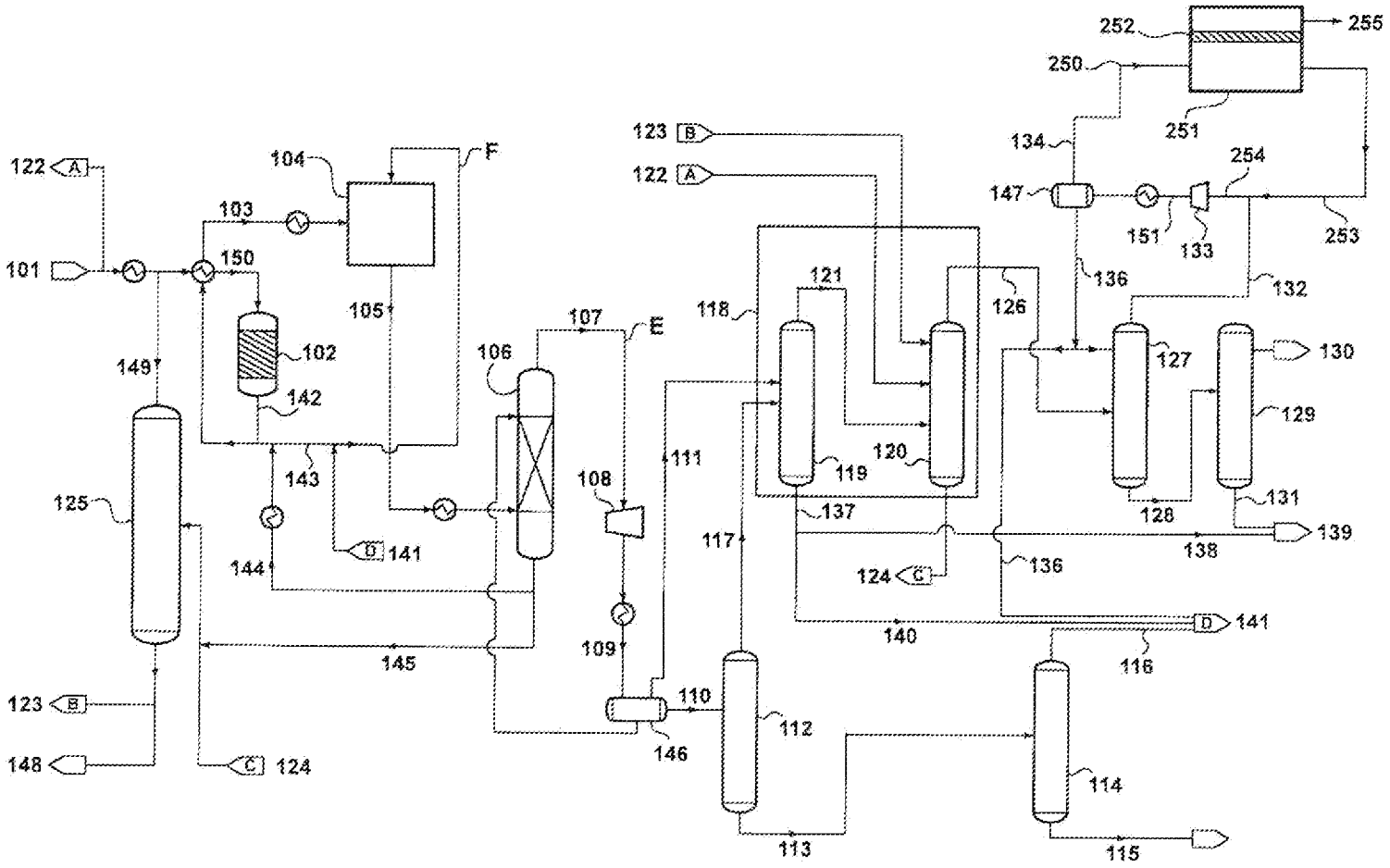
FIG. 2A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D 141
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FIG. 2B

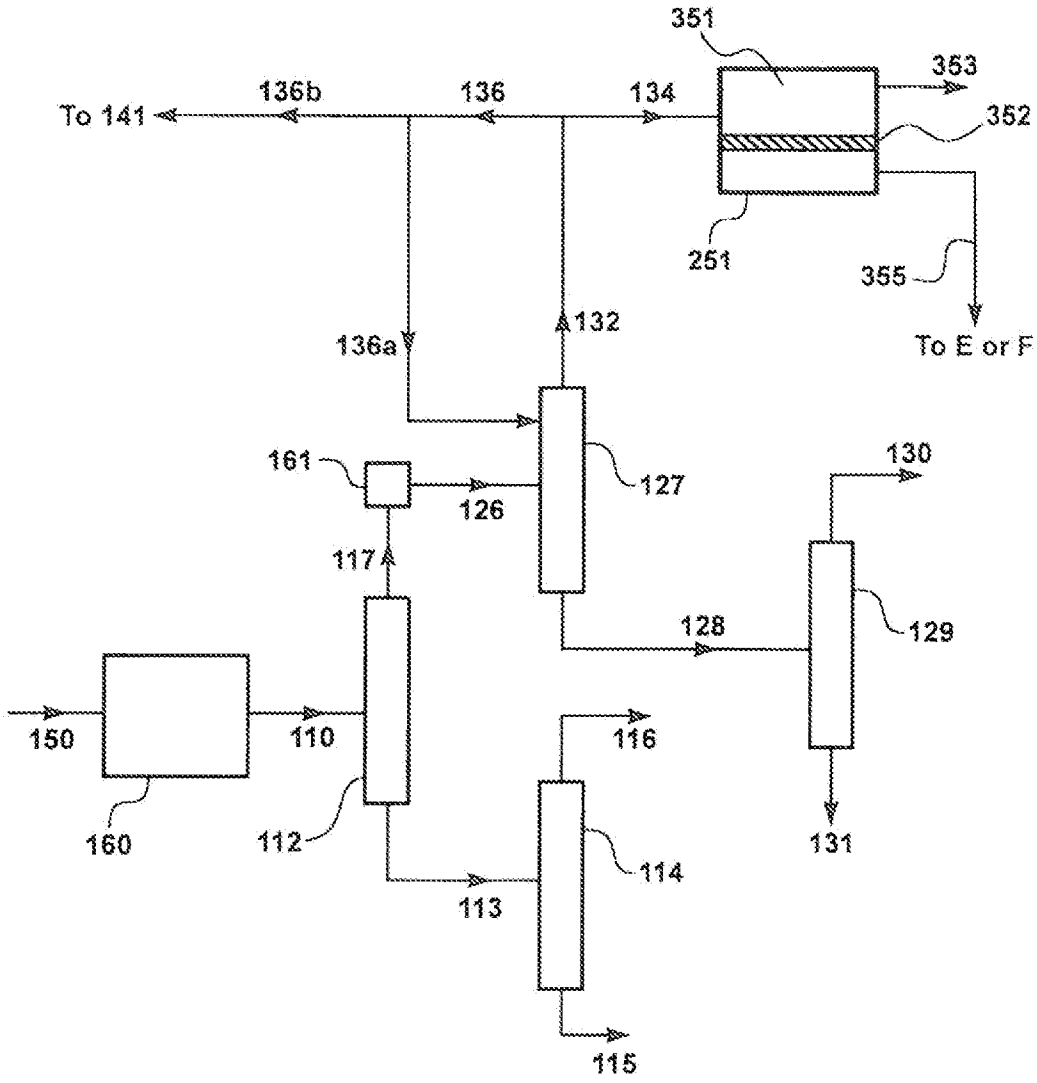
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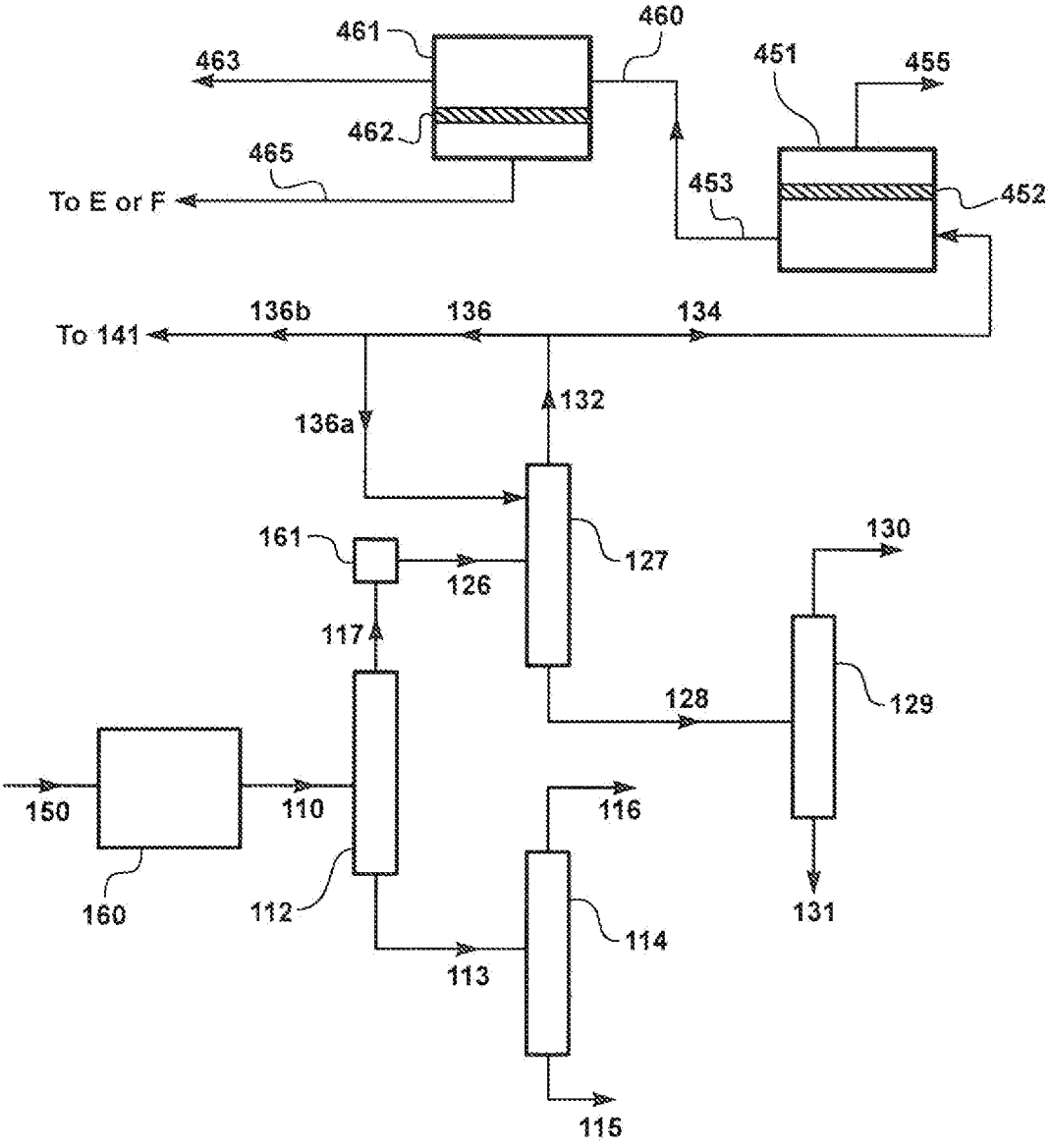
FIG. 3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115

FIG. 4

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Filer:	Janet E. Farrant/Jennifer Valcov
Attorney Docket Number:	976-177

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	98	98
Utility Search Fee	2111	1	310	310
Utility Examination Fee	2311	1	125	125
Pages:				
Claims:				
Claims in excess of 20	2202	9	31	279
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**812**

Electronic Acknowledgement Receipt

EFS ID:	15045167
Application Number:	13776362
International Application Number:	
Confirmation Number:	7293
Title of Invention:	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process
First Named Inventor/Applicant Name:	Paul Su
Customer Number:	26909
Filer:	Janet E. Farrant/Jennifer Valcov
Filer Authorized By:	Janet E. Farrant
Attorney Docket Number:	976-177
Receipt Date:	25-FEB-2013
Filing Date:	
Time Stamp:	18:24:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$812
RAM confirmation Number	22779
Deposit Account	505246
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

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Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	177ADS.pdf	1432568 5338fb979e7347ecfbd4fc02bdd99f5964fe5199	no	6
Warnings:					
Information:					
2	Oath or Declaration filed	177decl.pdf	494898 c7f561e7f01bd972f8e453ad31bc027715ef1c2f	no	1
Warnings:					
Information:					
3	Specification	177non-prov-spec.pdf	7466515 f606e416d6b8b27e696bcb094ef817c71426bf2b	no	23
Warnings:					
Information:					
4	Claims	177non-prov-claims.pdf	1213351 6678fc43a912b018d58ebf58e0eb2a8a53023e4d	no	5
Warnings:					
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5	Abstract	177non-prov-abst.pdf	97763 1e8e7c5f4b862a8dfedc224b5c664f37c1422f67	no	1
Warnings:					
Information:					
6	Information Disclosure Statement (IDS) Form (SB08)	177IDS.pdf	612087 30384871c2225a513168ea5e8c5c8fab249e4e1a	no	4
Warnings:					
Information:					
7	Power of Attorney	177PoA_Paul.pdf	495501 1e350fa1dcf1b333a1c8884c659e86385e7cac48	no	1
Warnings:					
Information:					
8	Drawings-only black and white line drawings	177non-prov-finalfigs.pdf	686166 c42cb149576b28a1cf1d0537a34e0d15c884a104	no	6
Warnings:					
Information:					

9	Fee Worksheet (SB06)	fee-info.pdf	36315 8d2031b9a73fcb1b14e73240dc571cbb323b3c51	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	12535164

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/14 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	976-177
	Application Number	
Title of Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Paul		Su	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Saratoga	State/Province	CA	Country of Residence i	US

Mailing Address of Inventor:

Address 1	13186 Stewart Ct		
Address 2			
City	Saratoga	State/Province	CA
Postal Code	95070	Country i	

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	26909		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process		
Attorney Docket Number	976-177	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	6	Suggested Figure for Publication (if any)	2A

PTO/AIA/14 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	976-177
	Application Number	
Title of Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process	

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	26909		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	non provisional of	61644121	2012-05-08

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
			◉ Yes ○ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

PTO/AIA/14 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	976-177
	Application Number	
Title of Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process	

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◯ Assignee	◯ Legal Representative under 35 U.S.C. 117	◯ Joint Inventor
◯ Person to whom the inventor is obligated to assign.	◯ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

PTO/AIA/14 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	976-177
	Application Number	
Title of Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process	

Mailing Address Information:			
Address 1			
Address 2			
City		**State/Province**	
Country [i]		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Non-Applicant Assignee Information:

Providing assignment information in this section does not subsitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1

Complete this section only if non-applicant assignee information is desired to be included on the patent application publication in accordance with 37 CFR 1.215(b). Do not include in this section an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest), as the patent application publication will include the name of the applicant(s).

Remove

If the Assignee is an Organization check here. ☒

Organization Name	Membrane Technology and Research, Inc.

Mailing Address Information:			
Address 1	39630 Eureka Drive		
Address 2			
City	Newark	**State/Province**	CA
Country [i]	US	Postal Code	94560
Phone Number	650-328-2228	Fax Number	650-328-6580
Email Address			

Additional Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

Signature	/KB/	Date (YYYY-MM-DD)	2013-02-25

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	976-177
	Application Number	
Title of Invention	Membrane Technology for Use in a Methanol-to-Propylene Conversion Process	

First Name	Kathi	Last Name	Bean	Registration Number	36644

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