UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 10,668,430 B2
APPLICATION NO. : 15/974343
DATED : June 2, 2020
INVENTOR(S) : Olson et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

In "Related U.S. Application Data", in Column 1, Line 1, delete "(60)" and insert --(63)-- therefor

On page 5, in Column 1, under "Other Publications", Line 18, delete "dated dated" and insert --dated-- therefor

On page 6, in Column 2, under "Other Publications", Line 45, delete "Actioin" and insert --Action-- therefor

On page 8, in Column 2, under "Other Publications", Line 27, delete "Combinded" and insert --Combined-- therefor

On page 8, in Column 2, under "Other Publications", Line 51, delete ""Effectsof" and insert --"Effects of-- therefor

On page 8, in Column 2, under "Other Publications", Line 52, delete "Reducton" and insert --Reduction-- therefor

In the Drawings

On sheet 6 of 11, Fig. 6, delete "O2" and insert --O_2-- therefor

In the Specification

In Column 8, Line 9, delete "SC_2," and insert --SCl_2,-- therefor

In Column 8, Line 56, delete "akali" and insert --alkali-- therefor

In Column 10, Line 36, delete "131*h*" and insert --131*b*-- therefor

Signed and Sealed this
Nineteenth Day of January, 2021

Andrei Iancu
Director of the United States Patent and Trademark Office

In Column 13, Line 34, after "eliminated", insert --.--

In Column 13, Line 43, after "system", insert --.--

In Column 14, Line 20, after "No", insert --.--

In Column 15, Line 7, delete "FGD." and insert --FGD,-- therefor

In Column 15, Line 7, delete "Marshall." and insert --Marshall,-- therefor

In Column 15, Line 38, after "temperatures", insert --.--

In Column 15, Line 49, delete "Miller." and insert --Miller,-- therefor

In Column 15, Line 59, delete "(12%)." and insert --(12%),-- therefor

In Column 15, Line 59, delete "(6 ppm)." and insert --(6 ppm),-- therefor

In Column 16, Line 17, after "Hg", insert --.--

In Column 18, Line 7, delete "eductor." and insert --educator.-- therefor

In Column 18, Line 34, delete "NO" and insert --NO_x-- therefor

In Column 20, Lines 5-6, delete "(11 $\mu m/m^3$)" and insert --(11 $\mu g/m^3$)-- therefor

In Column 20, Lines 65-66, delete "73%-69%°" and insert --73%-69%-- therefor

In Column 22, Line 21, delete "50%" and insert --5%-- therefor

In the Claims

In Column 35, Line 57, in Claim 1, after "thereof", insert --,--

In Column 37, Line 34, in Claim 28, delete "as," and insert --gas,-- therefor

In Column 38, Line 4, in Claim 28, delete "thereof," and insert --thereof;-- therefor

IN UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No.:	10,668,430 B2	Docket No:	4820.001US9
Issue Date:	Jun. 2, 2020	Patentee:	Midwest Energy Emissions Corp.
Customer No.:	21186	Confirmation No.:	1072
Title	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

REQUEST FOR CERTIFICATE OF CORRECTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
ATTN: CERTIFICATE OF CORRECTION BRANCH

It is requested that a Certificate of Correction be issued correcting printing errors appearing in the above-identified United States patent. A copy of the text of the Certificate in the suggested form is enclosed.

Authorization is given to charge Deposit Account No. 19-0743 in the amount of $160.00 to cover the Certificate of Correction Fee.

Issuance of the Certificate of Correction would neither expand nor contract the scope of the claims as properly allowed, and re-examination is not required.

The Examiner is authorized to charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully Submitted,

SCHWEGMAN, LUNDBERG & WOESSNER, P.A
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date : December 2, 2020

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No: 63,803

CERTIFICATE UNDER 37 CFR § 1.8: The undersigned hereby certifies that this correspondence is filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450, on this 2nd day of December 2020

Janine Heitland
Name

/Janine Heitland/
Signature

PTO/SB/44 (02-01)
Approved for use through 01/31/2004. OMB 0651-0033
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO : 10,668,430 B2 Page (1) of 3

DATED : Jun. 2, 2020

INVENTOR(S) : Olson et al.

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In column 8, line 56, delete "akali" and insert --alkali-- therefor

In column 10, line 36, delete "131*h*" and insert --131*b*-- therefor

In column 13, line 34, after "eliminated", insert --.--

MAILING ADDRESS OF SENDER:

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
Minneapolis, MN 55402

Atty Docket No: 4820.001US9

PATENT NO. 10,668,430

No. of additional copies

PTO/SB/44 (02-01)
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U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
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In column 20, lines 65-66, delete "73%-69%°" and insert --73%-69%-- therefor

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P.O. BOX 2938
Minneapolis, MN 55402

Atty Docket No: 4820.001US9

PATENT NO. 10,668,430

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PTO/SB/44 (02-01)
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In column 37, line 34, in Claim 28, delete "as," and insert --gas,-- therefor

In column 38, line 4, in Claim 28, delete "thereof," and insert --thereof;-- therefor

MAILING ADDRESS OF SENDER:

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
Minneapolis, MN 55402

Atty Docket No: 4820.001US9

PATENT NO. 10,668,430

No. of additional copies

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Midwest Energy Emissions Corp.
Examiner: Amber R. Orlando

Patent No.: 10,668,430 B2
Group Art Unit: 1776

Issue Date: Jun. 2, 2020
Docket No: 4820.001US9

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
ATTN: CERTIFICATE OF CORRECTION BRANCH

We are transmitting herewith the attached:

X Authorization to charge Deposit Account No. 19-0743 in the amount of $160.00 to cover the Certificate of Correction Fee.
X Request for Certificate of Correction. (1 pg.)
X Certificate of Correction Form - PTO-1050 (3 pgs.)

Please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
Customer No: 21186

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No: 63,803

CERTIFICATE UNDER 37 CFR § 1.8: The undersigned hereby certifies that this correspondence is filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450, on this 2nd day of December 2020.

Janine Heitland
Name

/Janine Heitland/
Signature

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Susan Yee/Janine Heitland
Attorney Docket Number:	4820.001US9

Filed as Large 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:				
CERTIFICATE OF CORRECTION	1811	1	160	160

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Electronic Acknowledgement Receipt

EFS ID:	41276817
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Susan Yee/Janine Heitland
Filer Authorized By:	Susan Yee
Attorney Docket Number:	4820.001US9
Receipt Date:	02-DEC-2020
Filing Date:	08-MAY-2018
Time Stamp:	16:30:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	E2020B2G31268752
Deposit Account	190743
Authorized User	Janine Heitland

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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		10668430COC.pdf	219900 43dce336eb3172e3864e7292945bd295cf5110eb	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Request for Certificate of Correction	2	5
	Transmittal Letter	1	1

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30392 3d8e8bb8449ac5ca0be41af36fbe0eae65eb0dca	no	2

Warnings:

Information:

Total Files Size (in bytes):	250292

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

Office of the Chief Financial Officer

Document Code:WFEE

User :75510

Sale Adjustment Accounting Date:10/26/2020

Effective Date	Sale Accounting Date	Sale Item Reference Number
09/27/2019	10/26/2020	15974343

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I20200P705494952	1501	UTILITY APPL ISSUE FEE	$1,000.00	DA

United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :75510

Refund Accounting Date:10/26/2020

Effective Date	Sale Item Reference Number	Refund Total
09/27/2019	15974343	$1,000.00

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method	Account Number
I20200P705494952	1501	UTILITY APPL ISSUE FEE	$1,000.00	DA	190743

PTO-2326 (04-2019)
Approved for use through 03/31/2021. OMB 0651-0043
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.

REQUEST FOR REFUND

Reference # *(Patent #, Application #, Trademark Serial #, Registration #, etc.)*	**Title of Invention or Mark Information**	
10,668,430	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	
Attorney Docket # *(if applicable)*	**Payment Date** *(mm/dd/yyyy)*	**Refund Request Amount**
4820.001US9	09/27/2019	$ 1,000.00

Refund Option *(Select one)*

- (●) If approved, issue the refund to the account associated with the original payment.
- ( ) If approved, and the original payment was a check, issue the refund to deposit account # _____.
- ( ) If approved, and the original payment was a check, issue the refund as a U.S. Treasury check.

Reason for Refund Request *Refund requests must generally be filed within 2 years of payment date (37 CFR 1.26 and 2.209)*

- [✔] Duplicate Payment
- [ ] No Fee Due
- [ ] Office Error
- [ ] Small Entity Later Established* (*must be filed within 3 months of payment date, 37 CFR 1.28)
- [ ] Other _____

Rationale *(Supporting documentation may be submitted with this form)*

Issue Fee was paid on September 27, 2019, but later was withdrawn due to unmarked references that came through which needed to be cited. We paid a second Issue Fee on April 20, 2020, so we'd like a refund of the original Issue Fee payment.

Requester's Information

Company or Firm Name *(if applicable)*		
Schwegman Lundberg & Woessner, P.A.		
Address Line 1	**City**	**State/Region**
121 South Eighth Street	Minneapolis	MN
Address Line 2 *(if applicable)*	**Country**	**Zip/Postal Code**
1600 TCF Tower	United States of America	55402
Email Address *(You will receive an acknowledgment of receipt only if you provide a valid email address)*	**Phone Number**	
request@slwip.com	612-373-6900	
Requester's Name		**Registration Number** *(if applicable)*
Nicholas Lanzatella		63,803
Signature		**Date** *(mm/dd/yyyy)*
/Nicholas Lanzatella/		10/21/2020

Submit online: EFS-Web *(registered users only; select "Request for Refund" from the document description menu)*, or
Fax to: 571-273-6500, or
Mail to: Director of the U.S. Patent and Trademark Office, Attn: Refunds, 2051 Jamieson Avenue, Suite 300, Alexandria, VA 22314

Electronic Acknowledgement Receipt

EFS ID:	40903635
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Janal M. Kalis/Megan Reed
Filer Authorized By:	Janal M. Kalis
Attorney Docket Number:	4820.001US9
Receipt Date:	21-OCT-2020
Filing Date:	08-MAY-2018
Time Stamp:	13:03:05
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		SIGNED_4820_001US9_Refund_Request_Form.pdf	807201 414b0e3786e727958439eb600e45a9ad82a2a95	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Refund Request	2	2
Warnings:			
Information:			
	Total Files Size (in bytes):	807201	

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	N/A
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Request for Refund (1 pg.)

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	06/02/2020	10668430	4820.001US9	1072

21186 7590 05/13/2020

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

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 0 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):

Edwin S. Olson, Grand Forks, ND;
Midwest Energy Emissions Corp., Corsicana, TX;
Michael J. Holmes, Thompson, ND;
John H. Pavlish, East Grand Forks, MN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket No.:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION RE: FEE ADDRESS

Mail Stop Issue Fee
Commissioner for Patents
P.O.Box 1450
Alexandria, VA 22313-1450

In response to the Notice of Allowance and Issue Fee Due, please record the Fee Address under the provisions of 37 CFR 1.363 as the following:

Customer Number 21186

Please direct any inquiries to the undersigned attorney at (612) 349-9580.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 4/20/2020 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

NPL:CMG:dmj

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner: Amber Orlando	
Serial No.:	15/974,343	Group Art Unit: 1776	
Filed:	May 8, 2018	Docket No.: 4820.001US9	
Customer No.: 21186		Confirmation No.: 1072	
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

RESPONSE TO EXAMINER'S REASONS FOR ALLOWANCE

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

In the Notice of Allowance dated April 13, 2020 the Examiner has set forth "Reasons for Allowance." Applicant agrees that the claims are patentable over the references of record, but does not necessarily agree with the reasons provided in the allowance, which are the Examiner's reasons rather than Applicant's and are in no way to be interpreted as admitted by Applicant. Applicant respectfully submits that the subject matter of each of the allowed claims is patentable for its respective recitation of the claimed combination as a whole. That is, the patentability of each claim rests on the combination of recited elements and limitations. As such, Applicant submits that no one element or limitation in particular should be deemed to impart or be required for patentability of the claims. Furthermore, Applicant submits that the dependent claims are allowable not only for their dependence from the allowed independent claims, but also for the additional subject matter recited in each of those dependent claims.

If necessary, please charge any additional fees or credit overpayment to Deposit Account 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 4/20/2020 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	James Lee Shands/Diana Johnson
Attorney Docket Number:	4820.001US9

Filed as Large 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	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt

EFS ID:	39205738
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	James Lee Shands/Diana Johnson
Filer Authorized By:	James Lee Shands
Attorney Docket Number:	4820.001US9
Receipt Date:	20-APR-2020
Filing Date:	08-MAY-2018
Time Stamp:	14:41:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	E20204JE41579284
Deposit Account	190743
Authorized User	Diana Johnson

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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		4820001US9IssuefeeSigned.pdf	382750 a27f7267fe37f48f0e717333b01474bad76c2502	yes	4

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Transmittal Letter	1	1
Issue Fee Payment (PTO-85B)	2	2
Miscellaneous Incoming Letter	3	3
Miscellaneous Incoming Letter	4	4

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30340 a73b16d4b044158d386aa26e7b5978d7e24e2104	no	2

Warnings:

Information:

Total Files Size (in bytes):	413090

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	July 13, 2020
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

Notice of Allowance Date: April 13, 2020

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We are transmitting herewith the following:

X Authorization to charge Deposit 19-0743 in the amount of $1,000.00 to cover the Large Entity Issue Fee Payment.
X Issue Fee Transmittal (Form PTOL-85).
X Communication Re: Fee Address (1 page).
X Response to Examiner's Reasons for Allowance (1 pg.)

Please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186
NPL:CMG:dmj

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 20th day of April, 2020.

Diana Johnson
Name

/Diana Johnson/
Signature

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

21186 7590 04/13/2020
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

Diana Johnson	(Typed or printed name)
/Diana Johnson/	(Signature)
4/20/2020	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

TITLE OF INVENTION: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$1000.00	$0	07/13/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
ORLANDO, AMBER ROSE	1776	095-142000

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 03-09 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 Schwegman Lundberg
2 & Woessner, P.A.
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Midwest Energy Emissions Corp.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Corsicana, TX

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

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 19-0743

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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.
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.
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 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Nicholas P. Lanzatella/ Date 4/20/2020

Typed or printed name Nicholas P. Lanzatella Registration No. 63,803

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

PAC ET AL EXHIBIT 1019
Page 27

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/974,343	05/08/2018	1776	2620	4820.001US9	16	1

CONFIRMATION NO. 1072

CORRECTED FILING RECEIPT

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

OC000000118274319

Date Mailed: 04/16/2020

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Edwin S. Olson, Grand Forks, ND;
Michael J. Holmes, Thompson, ND;
John H. Pavlish, East Grand Forks, MN;

Applicant(s)

Midwest Energy Emissions Corp., Corsicana, TX;

Power of Attorney: The patent practitioners associated with Customer Number 21186

Domestic Priority data as claimed by applicant

This application is a CON of 15/951,970 04/12/2018
which is a CON of 14/712,558 05/14/2015 PAT 10589225
which is a CON of 14/318,270 06/27/2014 PAT 9757689
which is a CON of 13/966,768 08/14/2013 PAT 8821819
which is a CON of 13/427,665 03/22/2012 PAT 8512655
which is a CON of 12/419,219 04/06/2009 PAT 8168147
which is a CON of 12/201,595 08/29/2008 ABN
which is a DIV of 11/209,163 08/22/2005 PAT 7435286
which claims benefit of 60/605,640 08/30/2004

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.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/05/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/974,343**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Preliminary Class

095

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor

community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION RE: UPDATE TO APPLICATION DATA SHEET

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

Applicants hereby request that the information provided on the Application Data Sheet filed in the above-referenced application on May 8, 2018, be updated with the information as provided on the enclosed marked up Application Data Sheet.

We therefore submit a marked up copy of the Application Data Sheet which shows an update to the Domestic Benefit/National Stage Information.

Once this request is entered, it is respectfully requested that the USPTO update their records and provide confirmation of the above request by way of an Updated Filing Receipt.

It is believed that no fee is required to fulfill this request, however, if necessary, please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

Schwegman Lundberg & Woessner, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 4/14/2020 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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:

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix

Residence Information (Select One) ☐ US Residency ☐ Non US Residency ☐ Active US Military Service

City		State/Province		Country of Residence	

Mailing Address of Inventor:

Address 1			
Address 2			
City		State/Province	
Postal Code		Country	

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	
Email Address	

Application Information:

Title of the Invention			
Attorney Docket Number		Small Entity Status Claimed ☐	
Application Type			
Subject Matter			
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country Publication

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). Enter either 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	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number			

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(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
This Application	continuation of	15/951,970	2018-04-12
Prior Application Status	Pending		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
15/951,970	continuation of	14/712,558	2015-05-14
Prior Application Status	Pending		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14/712,558	continuation of	14/318,270	2014-06-27
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
14/318,270	continuation of	13/966,768	2013-08-14
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
13/966,768	continuation of	13/427,665	2012-03-22
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
13/427,665	continuation of	12/419,219	2009-04-06
Prior Application Status	~~Patented~~Abandoned		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
12/419,219	continuation of	12/201,595	2008-08-29
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
12/201,595	~~continuation of~~division of	11/209,163	2005-08-22
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
11/209,163	Claims benefit of provisional	60/605,640	2004-08-30

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. 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(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)i the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the POX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant must opt-out of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is ONLY reviewed and processed with the INITIAL filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby grants the USPTO authority to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ **A. Applicant DOES NOT authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.**

☐ **B. Applicant DOES NOT authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.**

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

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:

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.

☐ 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:

☐ Deceased	☐ Legally incapacitated

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here: ☐

Organization Name:

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number			
Email Address			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Assignee Information including Non-Applicant Assignee 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.

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Nicholas J. Lanzatella/			Date (YYYY-MM-DD)	2020-04-14
First Name	Nicholas	Last Name	Lanzatella	Registration Number	63,803

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 22313-14**

Electronic Acknowledgement Receipt

EFS ID:	39157113
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	James Lee Shands/Diana Johnson
Filer Authorized By:	James Lee Shands
Attorney Docket Number:	4820.001US9
Receipt Date:	14-APR-2020
Filing Date:	08-MAY-2018
Time Stamp:	16:42:25
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		4820001US9UADSsigned.pdf	210150 9c59f15daf61afd722cc8b223f088eb37b6c7678	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Request for Corrected Filing Receipt	2	2
	Application Data Sheet	3	8
Warnings:			
Information:			
	Total Files Size (in bytes):	210150	

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9		
Filed:	May 8, 2018	Serial No.:	15/974,343
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the attached:

X Communication Re: Update to Application Data Sheet (1 Pg.).
X Marked Up Application Data Sheet (6 Pgs.).

It is believed that no additional fee is required. However, if necessary, please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

Schwegman Lundberg & Woessner, P.A.
Customer No.: 21186

/Nicholas P. Lanzatella/
By: Nicholas P. Lanzatella
Reg. No. 63,803

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 14th day of April, 2020.

Diana Johnson
Name

/Diana Johnson/
Signature

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

21186 7590 04/13/2020
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	
ART UNIT	PAPER NUMBER
1776	

DATE MAILED: 04/13/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

TITLE OF INVENTION: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$1000.00	$0	07/13/2020

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

21186 7590 04/13/2020
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

TITLE OF INVENTION: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$1000.00	$0	07/13/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
ORLANDO, AMBER ROSE	1776	095-142000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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.
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.
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.

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.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 04/13/2020

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	
ART UNIT	**PAPER NUMBER**
1776	

DATE MAILED: 04/13/2020

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 30 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.

Notice of Allowability	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA (FITF) 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 the correspondence filed 04/02/2020.
   ☐ 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 27-55 . 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 _____.

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

Terminal Disclaimer

The terminal disclaimer filed on 04/03/2020 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of **15/997,091; 15/509,071; 16/509,102; 16/509,146** has been reviewed and is accepted. The terminal disclaimer has been recorded.

Allowable Subject Matter

Claims 27-55 are allowed.

The following is an examiner's statement of reasons for allowance: see the reasons for allowance for application 15/997,091 now issued patent no. US 10, 596,517.

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."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

AMBER ROSE. ORLANDO
Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO
Inventor Search (EAST)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	01/07/2019	AO
IDS Search (DAV and EAST)	08/17/2019	AO
IDS Search (DAV and EAST)	11/25/2019	AO

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	SEE EAST SEARCH HISTORY	09/09/2019	AO

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	**Art Unit**
	AMBER R ORLANDO	1776

CPC						
Symbol					**Type**	**Version**
B01D	/	53	/	64	F	2013-01-01
B01D	/	53	/	10	I	2013-01-01
B01J	/	20	/	20	I	2013-01-01
B01J	/	20	/	02	I	2013-01-01
B01J	/	20	/	0262	I	2013-01-01
B01J	/	20	/	027	I	2013-01-01
B01J	/	20	/	04	I	2013-01-01
B01J	/	20	/	041	I	2013-01-01
B01J	/	20	/	043	I	2013-01-01
B01J	/	20	/	10	I	2013-01-01
B01J	/	20	/	106	I	2013-01-01
B01J	/	20	/	12	I	2013-01-01
B01J	/	20	/	223	I	2013-01-01
B01J	/	20	/	28004	I	2013-01-01
B01J	/	20	/	28016	I	2013-01-01
B01J	/	20	/	3416	I	2013-01-01
B01J	/	20	/	22	I	2013-01-01
B01D	/	2253	/	102	A	2013-01-01
B01D	/	2257	/	602	A	2013-01-01
Y10S	/	95	/	901	A	2013-01-01
B01J	/	2220	/	42	A	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	07 April 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	29	11

U.S. Patent and Trademark Office — Part of Paper No.: 20200407

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	**Art Unit**
	AMBER R ORLANDO	1776

INTERNATIONAL CLASSIFICATION				
CLAIMED				
B01D	/	53	/	64
B01D	/	53	/	10
B01J	/	20	/	20
B01J	/	20	/	22

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	07 April 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	29	11

U.S. Patent and Trademark Office — Part of Paper No.: 20200407

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	**Art Unit**
	AMBER R ORLANDO	1776

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

CLAIMS

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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	07 April 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	29	11

U.S. Patent and Trademark Office — Part of Paper No.: 20200407

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO	*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	**Application Number**	15/974,343
	Filing Date	May 8, 2018
(Use as many sheets as necessary)	**First Named Inventor**	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,589,225	3/17/2020	Olson, Edwin S, et al.
	US-10,596,517	3/24/2020	Olson, Edwin S, et al.
	US-20200009532A1	1/9/2020	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Notice of Allowance mailed 12-13-19", 7 pgs	
	"Application Serial No. 15/382,114, Non Final Office Action mailed 12-31-19", 33 pgs	
	"Application Serial No. 15/997,091, Corrected Notice of Allowability mailed 11-22-19", 3 pgs	
	"Application Serial No. 16/130,670, Non Final Office Action mailed 12-16-19", 8 pgs	
	"Application Serial No. 16/509,071, Final Office Action mailed 12-12-19", 23 pgs	
	"Application Serial No. 16/509,102, Amendment and Response filed 11-11-19 to Non Final Office Action mailed 10-23-19", 34 pgs.	
	"Application Serial No. 16/509,102, Final Office Action mailed 02-14-20", 13 pgs	
	"Application Serial No. 16/509,146, Amendment and Response filed 11-11-19 to Non Final Office Action mailed 10-17-19", 34 pgs.	
	"Application Serial No. 16/509,146, Final Office Action mailed 02-14-20", 23 pgs	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 04/07/2020

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
* 15/974,343 *	15/974,343	Olson et al.	
	Examiner	**Art Unit**	
	ORLANDO, AMBER ROSE	1776	

Document Code - DISQ	**Internal Document - DO NOT MAIL**

TERMINAL DISCLAIMER	☑ APPROVED	☐ DISAPPROVED
Date Filed: 02 April 2020	**This patent is subject to a Terminal Disclaimer**	

Approved/Disapproved by:

/LAWANA R HIXON/

Technology Center: OPLC

Telephone: (571)272-6074

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 15/974,343	Filing Date 05/08/2018	☐ To be Mailed

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), (l), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	04/02/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 29	Minus	** 29	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/TONYA Q MCBRIDE/
*** 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.	

This collection of information is required by 37 CFR 1.16. 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, 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,589,225	3/17/2020	Olson, Edwin S, et al.
	US-10,596,517	3/24/2020	Olson, Edwin S, et al.
	US-20200009532A1	1/9/2020	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Notice of Allowance mailed 12-13-19", 7 pgs	
	"Application Serial No. 15/382,114, Non Final Office Action mailed 12-31-19", 33 pgs	
	"Application Serial No. 15/997,091, Corrected Notice of Allowability mailed 11-22-19", 3 pgs	
	"Application Serial No. 16/130,670, Non Final Office Action mailed 12-16-19", 8 pgs	
	"Application Serial No. 16/509,071, Final Office Action mailed 12-12-19", 23 pgs	
	"Application Serial No. 16/509,102, Amendment and Response filed 11-11-19 to Non Final Office Action mailed 10-23-19", 34 pgs.	
	"Application Serial No. 16/509,102, Final Office Action mailed 02-14-20", 13 pgs	
	"Application Serial No. 16/509,146, Amendment and Response filed 11-11-19 to Non Final Office Action mailed 10-17-19", 34 pgs.	
	"Application Serial No. 16/509,146, Final Office Action mailed 02-14-20", 23 pgs	

EXAMINER DATE CONSIDERED

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Janal M. Kalis/Megan Reed
Attorney Docket Number:	4820.001US9

Filed as Large 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 $0 paid	1251	1	200	200
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
		Total in USD ($)		**600**

Electronic Acknowledgement Receipt

EFS ID:	39043547
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Janal M. Kalis/Megan Reed
Filer Authorized By:	Janal M. Kalis
Attorney Docket Number:	4820.001US9
Receipt Date:	02-APR-2020
Filing Date:	08-MAY-2018
Time Stamp:	12:42:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$600
RAM confirmation Number	E202042C42590476
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIGNED_4820_001US9_NFOAR espExtTD_SIDS.pdf	451550 97c15b32ade55d191a339409c4e63b4ec366b869	yes	19

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Amendment/Req. Reconsideration-After Non-Final Reject	2	2
Claims	3	8
Applicant Arguments/Remarks Made in an Amendment	9	14
Extension of Time	15	15
Terminal Disclaimer Filed	16	16
Transmittal Letter	17	18
Information Disclosure Statement (IDS) Form (SB08)	19	19

Warnings:

Information:

2	Non Patent Literature	0001_2_npl_4820007us5_aarn_111119_f.pdf	364377 f73c8815c2a1102e9c0caee803f1996821aa94d9	no	34

Warnings:

Information:

3	Non Patent Literature	0002_2_npl_4820001u10_cnoa_11222019_f.pdf	106525 6b910c43a556bcbac9dc20df8d512868661401 2f	no	3

Warnings:

Information:

4	Non Patent Literature	0003_2_npl_4820001u11_foar_12122019_f.pdf	996874 61c02eef2c3ba29a842bbb99ea9f113a2ee7a735	no	23
Warnings:					
Information:					
5	Non Patent Literature	0004_2_npl_4820001u12_aarn_111119_f.pdf	1565094 55800251638 45b8e634abad18de7c26363485f3	no	34
Warnings:					
Information:					
6	Non Patent Literature	0005_2_npl_4820001u12_foar_02142020_f.pdf	612179 69e13f065dc065a7ed87a189b5a9f7d037504017	no	13
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_4820001us7_noar_12132019_f.pdf	503008 5b2d3b6f139c8ab7363a5ea2f6356595c0d0c21d	no	7
Warnings:					
Information:					
8	Non Patent Literature	0007_2_npl_4820004us1_oarn_12312019_f.pdf	1599513 34f926e582884cce3fab4280bfdc2c6b597b4aee	no	33
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_4820005us2_oarn_12162019_f.pdf	272067 edacb8c65b2eabcc646490f9a5df1bb7d918308a	no	8
Warnings:					
Information:					
10	Non Patent Literature	0009_2_npl_4820007us5_foar_02142020_f.pdf	1035614 91f62a7509fe183f13b08132b611750f9c2b1a2c	no	23
Warnings:					
Information:					

11	Fee Worksheet (SB06)	fee-info.pdf	33887 48123a623d5adfed87094610c6ed90c78525fd42	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	7540688	

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	April 2, 2020
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Amendment and Response under 37 C.F.R. § 1.111 (13 pgs.)
X Petition for Extension of Time (1 pg.)
X Authorization to charge Deposit Account 19-0743 in the amount of $200.00 to cover the Extension of Time Fee.
X Information Disclosure Statement (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (9).
X Authorization to charge Deposit Account 19-0743 in the amount of $240.00 to cover the fee for consideration of Information Disclosure Statement under 37 C.F.R. § 1.97(c).
X Terminal Disclaimer (1 pg.)
X Authorization to charge Deposit Account 19-0743 in the amount of $160.00 to cover the fee for the Terminal Disclaimer

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/974,343 Group Art Unit: 1776
Filed: May 8, 2018 Docket No.: 4820.001US9
Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.111

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

Applicant has received the Non-Final Office Action dated December 2, 2019. Please enter the following.

This response is accompanied by a Petition, as well as the appropriate fee, to obtain a one-month extension of the period for responding to the Office Action, thereby moving the deadline for response from March 2, 2020 to April 2, 2020.

IN THE CLAIMS

Please amend the claims as follows:

1.-26. (Canceled)

27. (Currently Amended) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein

the coal comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;

contacting mercury in the mercury-containing gas with the sorbent; and

separating the sorbent contacted with the mercury from the mercury-containing gas.

28. (Currently Amended) The method of claim 27, wherein the coal comprises the ~~added~~additive comprising the Br_2, HBr, the bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber.

29. (Currently Amended) The method of claim 27, wherein the combustion chamber comprises the ~~added~~additive comprising the Br_2, HBr, the bromide compound, or a combination thereof.

30. (Currently Amended) The method of claim 27, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the additive comprising the Br_2, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the additive comprising the Br_2, HBr, bromide compound, or combination thereof, to the coal is performed at the coal-combustion facility.

31. (Currently Amended) The method of claim 27, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the additive comprising the Br_2, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the additive comprising the Br_2, HBr, bromide compound, or combination thereof, to the coal is performed at a site other than the coal-combustion facility.

32. (Previously Presented) The method of claim 27, wherein the combustion chamber is an electric utility coal combustion chamber.

33. (Previously Presented) The method of claim 27, wherein the combustion chamber is a coal combustion furnace.

34. (Previously Presented) The method of claim 27, wherein the coal comprises a subbituminous coal.

35. (Previously Presented) The method of claim 27, wherein the coal comprises a lignite coal.

36. (Previously Presented) The method of claim 27, further comprising
measuring the mercury content of the mercury-containing gas; and
modifying, in response to the measured mercury content of the mercury-containing gas,
an injection rate of injecting the sorbent into the mercury-containing gas,
an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or
a combination thereof.

37. (Previously Presented) The method of claim 36, wherein the measuring of the mercury content comprises continuous measurement.

38. (Previously Presented) The method of claim 27, further comprising:

modifying, in response to a measured mercury content,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

39. (Previously Presented) The method of claim 27, wherein the mercury-containing gas comprises about 1 g to about 30 g of the element bromine per 100 g of the sorbent.

40. (Previously Presented) The method of claim 27, wherein the sorbent contacted with the mercury comprises the element bromine and mercury.

41. (Previously Presented) The method of claim 27, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas.

42. (Previously Presented) The method of claim 27, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas with the sorbent.

43. (Previously Presented) The method of claim 27, wherein the sorbent in the mercury-containing gas comprises about 1 g to about 30 g of the added Br_2, HBr, the bromide compound, or a combination thereof, per 100 g of the sorbent.

44. (Previously Presented) The method of claim 27, wherein the Br_2, HBr, or the bromide compound is contacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.

45. (Previously Presented) The method of claim 27, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.

46. (Previously Presented) The method of claim 27, wherein the sorbent injected into the mercury-containing gas is a sorbent obtained by contacting a sorbent with a halogen or halide promoter prior to the injection of the sorbent into the mercury-containing gas.

47. (Previously Presented) The method of claim 27, wherein the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.

48. (Previously Presented) The method of claim 27, wherein the combustion chamber comprises a boiler.

49. (Previously Presented) The method of claim 27, wherein the mercury-containing gas is a flue gas.

50. (Previously Presented) The method of claim 27, wherein the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator, a scrubber, or a combination thereof.

51. (Currently Amended) The method of claim 50, wherein the particulate separator comprises a baghouse, [[a]]an electrostatic precipitator, a fabric filter, or a combination thereof.

52. (Previously Presented) The method of claim 27, wherein a halide sorbent enhancement additive comprises the added Br_2, HBr, bromide compound, or combination thereof.

53. (Previously Presented) The method of claim 52, wherein the sorbent enhancement additive comprises the bromide compound.

54. (Currently Amended) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br˚, or a combination thereof, wherein

the coal comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;

contacting mercury in the mercury-containing gas with the sorbent; and

separating the sorbent contacted with the mercury from the mercury-containing gas.

55. (Currently Amended) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br˚, or a combination thereof, wherein

the coal comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent;

contacting mercury in the mercury-containing gas with the promoted sorbent;

separating the promoted sorbent contacted with the mercury from the mercury-containing gas;

measuring the mercury content of the mercury-containing gas; and

modifying, in response to the measured mercury content,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

REMARKS

This responds to the Non-Final Office Action dated December 2, 2019.

Claims 27-31, 51, and 54-55 are presently amended. No claims are presently canceled, and claims 1-26 were canceled previously. No new claims are presently added. As a result, claims 27-55 are now pending in this application.

Independent claim 27 is presently amended to recite "…the coal comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof…." Independent claims 54-55, and dependent claims 28-31, are correspondingly amended.

Dependent claim 51 is presently amended to correct a typographical error.

No new matter is added via the amendments herein.

Priority

The Office Action states:

> Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, 365(c), or 386(c) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:
>
> The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of 35 U.S.C. 112(a) or the first paragraph of pre-AIA 35 U.S.C. 112, except for the best mode requirement. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994)
>
> The disclosure of the prior-filed application, Application No. 60/605640, 11/209,163, 12/201,595, 12/419,219, 13/427665, 13/966,768, 14/318,270, 14/712,558, 15/951,970, fails to provide adequate support or enablement in the manner provided by 35 U.S.C. 112(a) or pre-AIA 35 U.S.C. 112, first paragraph for one or more claims of this application. These applications do not disclose the coal comprising Br_2, HBr, a bromide compound or a combination thereof.

These statements of the Office Action are respectfully traversed.

Merely to expedite prosecution, independent claim 27 is presently amended to recite "…the coal comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof…." Independent claims 54-55, and dependent claims 28-31, are correspondingly amended.

The amendments align the additive feature in the present claims with claim 1 of the related matter U.S. application no. 15/997,091 now issued as U.S. patent no. 10,596,517. Claim 1 of U.S. patent no. 10,596,517 recites "…the coal comprising an additive comprising Br_2, HBr, a bromide compound, or a combination thereof…."

Applicant therefore respectfully requests reconsideration and withdrawal of the conclusion that the prior-filed applications do not provide support for the claim features.

The Rejection of Claims Under §112

I. The Office Action rejected claims 27-54 under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph, as allegedly failing to comply with the written description requirement.

The Office Action states:

> Claims 27-54 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. The originally filed disclosure does not disclose the coal comprising added Br_2, HBr, a bromide compound or a combination thereof.

This rejection is respectfully traversed. Applicant does not agree that the originally filed disclosure does not disclose the feature.

However, merely to expedite prosecution, independent claim 27 is presently amended to recite "…the coal comprises ~~added~~an additive comprising Br_2, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises ~~added~~an additive comprising Br_2, HBr, a bromide

compound, or a combination thereof…." Independent claims 54-55, and dependent claims 28-31, are correspondingly amended.

The amendments align the additive feature in the present claims with claim 1 of the related matter U.S. application no. 15/997,091 now issued as U.S. patent no. 10,596,517. Claim 1 of U.S. patent no. 10,596,517 recites "…the coal comprising an additive comprising Br_2, HBr, a bromide compound, or a combination thereof…."

Dependent claims 28-52 are directly or indirectly dependent on independent claim 27. As such, these dependent claims incorporate all the features of claim 27. Accordingly, dependent claims 28-52 are patentable for at least the reasons given herein for patentability of independent claim 27.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 27-54 under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph.

Double Patenting Rejections

II. Double patenting rejections.

II(A). The Office Action provisionally rejected claims 27-54 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/951,970.

This rejection is respectfully traversed. Applicant does not admit that claims 27-54 are obvious over claims 1-20 of copending application no. 15/951,970. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 was already filed 8/28/2019 to obviate this rejection.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

II(B). The Office Action provisionally rejected claims 27-54 on the ground of nonstatutory double patenting over claims 1, 9, 10, 12, 16, and 18-42 of copending application no. 15/997,091.

This rejection is respectfully traversed. Applicant does not admit that claims 27-54 are obvious over claims 1, 9, 10, 12, 16, and 18-42 of copending application no. 15/997,091. However,

merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate this rejection.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

II(C). The Office Action provisionally rejected claims 27-54 on the ground of nonstatutory double patenting over claims 1-29 of copending application no. 16/509,071.

This rejection is respectfully traversed. Applicant does not admit that claims 27-54 are obvious over claims 1-29 of copending application no. 16/509,071. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate this rejection.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

II(D). The Office Action provisionally rejected claims 27-54 on the ground of nonstatutory double patenting over claims 1-30 of copending application no. 16/509,146.

This rejection is respectfully traversed. Applicant does not admit that claims 27-54 are obvious over claims 1-30 of copending application no. 16/509,146. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate this rejection.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

II(E). The Office Action provisionally rejected claims 27-54 on the ground of nonstatutory double patenting over claims 1-30 of copending application no. 16/509,102.

This rejection is respectfully traversed. Applicant does not admit that claims 27-54 are obvious over claims 1-30 of copending application no. 16/509,102. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate this rejection.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

CONCLUSION

It is respectfully submitted that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone the undersigned at (612) 349-9580 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402-0938
(612) 373-6900

Date April 2, 2020

By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

PETITION FOR A ONE-MONTH EXTENSION OF TIME

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

In accordance with the provision of 37 C.F.R § 1.136(a), it is respectfully requested that a one-month extension of time be granted in which to respond to the Non-Final Office Action mailed December 2, 2019, said period of response being extended from March 2, 2020 to April 2, 2020.

Please charge Deposit Account No. 19-0743 in the amount of $200.00 to cover the required extension fee. Please charge any additional fees or credit overpayment to deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date April 2, 2020

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

Modified PTO/AIA/25 (04-13)
Approved for use through 11/30/2020. OMB 0651-0031
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

TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number 4820.001US9

In re Application of: EDWIN S. OLSON ET AL.
Application No.: 15/974,343
Filed: May 8, 2018
For: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

The applicant, **Midwest Energy Emissions Corp**, owner of **100** percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number(s) **15/997,091; 16/509,071; 16/509,102; 16/509,146**, filed, **06/04/18; 07/11/19; 07/11/19; 07/11/19**, as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the reference application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said reference application, "as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application," in the event that: any such patent granted on the pending reference application expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate:

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

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

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 63,803

/ Nicholas P. Lanzatella / April 2, 2020
Signature **Date**

Nicholas P. Lanzatella
Typed or printed name

Attorney/Agent of Record (612) 349-9580
Title **Telephone Number**

☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

This collection of information is required by 37 CFR 1.321. 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 1.11 and 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, 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Amber Orlando
Serial No.: 15/974,343	Group Art Unit: 1776
Filed: May 8, 2018	Docket: 4820.001US9
Customer No.: 21186	Confirmation No.: 1072

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(c)(2), Applicant hereby authorizes the Commissioner to charge the fee of $240.00 as set forth in 37 C.F.R. § 1.17(p), to Deposit Account No. 19-0743. Please charge any additional fees or deficiencies, or credit any overpayment to Deposit Account No. 19-0743.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date April 2, 2020 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:mlr1

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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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
15/974,343	05/08/2018	1776	2620	4820.001US9	16	1

CONFIRMATION NO. 1072

CORRECTED FILING RECEIPT

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402



Date Mailed: 01/30/2020

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Edwin S. Olson, Grand Forks, ND;
Michael J. Holmes, Thompson, ND;
John H. Pavlish, East Grand Forks, MN;

Applicant(s)

Midwest Energy Emissions Corp., Corsicana, TX;

Power of Attorney: The patent practitioners associated with Customer Number 21186

Domestic Priority data as claimed by applicant

This application is a CON of 15/951,970 04/12/2018
which is a CON of 14/712,558 05/14/2015
which is a CON of 14/318,270 06/27/2014 PAT 9757689
which is a CON of 13/966,768 08/14/2013 PAT 8821819
which is a CON of 13/427,665 03/22/2012 PAT 8512655
which is a CON of 12/419,219 04/06/2009 PAT 8168147
which is a CON of 12/201,595 08/29/2008 ABN
which is a CON of 11/209,163 08/22/2005 PAT 7435286
which claims benefit of 60/605,640 08/30/2004

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.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/05/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/974,343**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Preliminary Class

095

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor

community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION RE: UPDATE TO APPLICATION DATA SHEET

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

Applicants hereby request that the information provided on the Application Data Sheet filed in the above-referenced application on May 8, 2018, be updated with the information as provided on the enclosed marked up Application Data Sheet.

We therefore submit a marked up copy of the Application Data Sheet which shows an update to the applicant information.

Once this request is entered, it is respectfully requested that the USPTO update their records and provide confirmation of the above request by way of an Updated Filing Receipt.

It is believed that no fee is required to fulfill this request, however, if necessary, please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

Schwegman Lundberg & Woessner, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 01/28/2020 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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:

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix

Residence Information (Select One) ☐ US Residency ☐ Non US Residency ☐ Active US Military Service

City		State/Province		Country of Residence	

Mailing Address of Inventor:

Address 1			
Address 2			
City		State/Province	
Postal Code		Country	

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	
Email Address	

Application Information:

Title of the Invention			
Attorney Docket Number		Small Entity Status Claimed ☐	
Application Type			
Subject Matter			
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country Publication

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). Enter either 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	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number			

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(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status			
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Foreign Priority Information:

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

This section allows for the applicant to claim priority to a foreign application. 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(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)i the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the POX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant must opt-out of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is ONLY reviewed and processed with the INITIAL filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby grants the USPTO authority to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ **A. Applicant DOES NOT authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.**

☐ **B. Applicant DOES NOT authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.**

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

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: Midwest Energy Emissions Corp.

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.

☒ **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:

☐ **Deceased**	☐ **Legally incapacitated**

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here: ☒

Organization Name: Midwest Energy Emissions Corp.

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1	~~670 D Enterprise Dr.~~ 1810 Jester Dr		
Address 2			
City	~~Lewis Center~~ Corsicana	**State/Province**	~~OH~~ TX
Country	United States of America	**Postal Code**	~~43035~~ 75109
Phone Number			
Email Address			

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Assignee Information including Non-Applicant Assignee 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.

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is **a juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Nicholas P. Lanzatella/			Date (YYYY-MM-DD)	2020-01-28
First Name	Nicholas	Last Name	Lanzatella	Registration Number	63,803

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 22313-14**

Amended PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Midwest Energy Emissions Corp

Application No./Patent No.: 15/974,343 Filed/Issue Date: May 8, 2018

Titled: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Midwest Energy Emissions Corp a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3 ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel , Frame, or for which a copy thereof is attached.

B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: PAVLISH, JOHN H. To: ENERGY AND ENVIRONMENTAL RESEARCH CENTER FOUNDATION

   The document was recorded in the United States Patent and Trademark Office at

   Reel 050462, Frame 0111, or for which a copy thereof is attached.

2. From: OLSON, EDWIN S. To: ENERGY AND ENVIRONMENTAL RESEARCH CENTER FOUNDATION

   The document was recorded in the United States Patent and Trademark Office at

   Reel 050461, Frame 0076, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 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, 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.**

Amended PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: HOLMES, MICHAEL J. To: NERGY AND ENVIRONMENTAL RESEARCH CENTER FOUNDATION

The document was recorded in the United States Patent and Trademark Office at

Reel 050461, Frame 0741, or for which a copy thereof is attached.

4. From: NERGY AND ENVIRONMENTAL RESEARCH CENTER FOUNDATION To: MIDWEST ENERGY EMISSIONS CORP.

The document was recorded in the United States Patent and Trademark Office at

Reel 050462, Frame 0607, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Nicholas P. Lanzatella/
Signature

01/28/2020
Date

Nicholas P. Lanzatella
Printed or Typed Name

USPTO Reg. No. 63,803
Title or Registration Number

Electronic Acknowledgement Receipt

EFS ID:	38422372
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Garrett M. Hall/Diana Johnson
Filer Authorized By:	Garrett M. Hall
Attorney Docket Number:	4820.001US9
Receipt Date:	28-JAN-2020
Filing Date:	08-MAY-2018
Time Stamp:	15:58:55
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		4820001US9UpdatedADSsigned.pdf	371739 6ea3fb63aecd13222a6bf0da9b8751e54e74c0e1	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Request for Corrected Filing Receipt	2	2
	Application Data Sheet	3	8
	Assignee showing of ownership per 37 CFR 3.73	9	10
Warnings:			
Information:			
	Total Files Size (in bytes):	371739	

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9		
Filed:	May 8, 2018	Serial No.:	15/974,343
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the attached:

X Communication Re: Update to Application Data Sheet (1 Pg.).
X Marked Up Application Data Sheet (6 Pgs.).
X Statement Under 37 CFR 3.73 (c) (2 pgs.)

It is believed that no additional fee is required. However, if necessary, please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

Schwegman Lundberg & Woessner, P.A.
Customer No.: 21186

/By Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 28th day of January, 2020.

Diana Johnson
Name

/Diana Johnson/
Signature

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 12/02/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
12/02/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Office Action Summary	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA (FITF) 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 08/28/2019.

☐ 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) 27-55 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) 27-55 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 05/08/2018 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.

Priority

Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, 365(c), or 386(c) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of 35 U.S.C. 112(a) or the first paragraph of pre-AIA 35 U.S.C. 112, except for the best mode requirement. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994)

The disclosure of the prior-filed application, Application No. 60/605640, 11/209,163, 12/201,595, 12/419,219, 13/427665, 13/966,768, 14/318,270, 14/712,558, 15/951,970, fails to provide adequate support or enablement in the manner provided by 35 U.S.C. 112(a) or pre-AIA 35 U.S.C. 112, first paragraph for one or more claims of this application. These applications do not disclose the coal comprising Br_2, HBr, a bromide compound or a combination thereof.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 27-54 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. The originally filed disclosure does not disclose the coal comprising added Br_2, HBr, a bromide compound or a combination thereof.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research

agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 27-54 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/951970 ('970) in view of Felsvang et al. US 5,435,980.

'970 discloses the claimed invention except for the coal comprising the additive.

Felsvang et al. discloses this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '970 reference to include the coal comprising the additive (Felsvang et al. column 4, lines 39-45) so as to supplement the halogen content of the system so as to increase the mercury sorption capability and because the halogen compounds are recognized equivalents for the removal of Hg.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-54 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1,9,10,12,16 and 18-42 of copending Application No. 15/997,091 ('091).

Although the claims at issue are not identical, they are not patentably distinct from each other because the subject matter within '091 contains substantially the same subject matter as that of the currently claimed invention.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-54 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-29 of copending Application No. 16/509,071('071) in view of Srinivasachar et al. US 2004/0244657.

'071 discloses the claimed invention except for the additive and the additive comprising Br_2, HBr, a bromide compound or a combination thereof.

Srinivasachar et al. disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '594 reference to include the additive comprising Br_2, HBr, a bromide compound or a combination thereof (Srinivasachar et al. paragraphs [0036] and [0039]) as Srinivasachar et al. discloses bromide compounds and iodide compounds as function equivalents of Hg sorbents.

Claims 27-54 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 16/509,146('146).

Although the claims at issue are not identical, they are not patentably distinct from each other because the subject matter within '146 contains substantially the same subject matter as that of the currently claimed invention.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-54 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 16/509,102('102).

Although the claims at issue are not identical, they are not patentably distinct from each other because the subject matter within '146 contains substantially the same subject matter as that of the currently claimed invention.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

AMBER ROSE. ORLANDO

Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Notice of References Cited	Application/Control No. 15/974,343	Applicant(s)/Patent Under Reexamination Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	Page 1 of 4

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-8168147-B2	05-2012	Olson; Edwin S.	B01J20/22	423/210
*	B	US-7435286-B2	10-2008	Olson; Edwin S.	B01J20/0262	95/142
*	C	US-6848374-B2	02-2005	Srinivasachar; Srivats	B01D53/10	110/165R
*	D	US-20040003716-A1	01-2004	Nelson, Sidney G. JR.	B01D53/02	95/134
*	E	US-6136749-A	10-2000	Gadkaree; Kishor P.	B01D53/8665	502/180
*	F	US-5569436-A	10-1996	Lerner; Bernard J.	B01D53/64	110/235
*	G	US-20090320678-A1	12-2009	Chang; Ramsay	B01D46/002	95/92
*	H	US-7780765-B2	08-2010	Srinivasachar; Srivats	B01D53/10	110/203
*	I	US-7514052-B2	04-2009	Lissianski; Vitali Victor	B01D53/56	423/210
*	J	US-6818043-B1	11-2004	Chang; Ramsay	B01D53/64	423/213.2
*	K	US-20040086439-A1	05-2004	Vosteen, Bernhard	B01D53/64	423/210
*	L	US-6719828-B1	04-2004	Lovell; John S.	B01D53/02	423/210
*	M	US-6558454-B1	05-2003	Chang; Ramsay	B01D53/10	110/342

FOREIGN PATENT DOCUMENTS

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NON-PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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Notice of References Cited	Application/Control No. 15/974,343	Applicant(s)/Patent Under Reexamination Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	Page 2 of 4

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*	A	US-6372187-B1	04-2002	Madden; Deborah A.	B01D53/508	110/345
*	B	US-20070180990-A1	08-2007	Downs; William	B01D53/10	95/134
*	C	US-5435980-A	07-1995	Felsvang; Karsten S.	B01D53/10	423/210
*	D	US-20180133646-A1	05-2018	Pavlish; John H.	B01J20/3416	1/1
*	E	US-20170100692-A1	04-2017	Olson; Edwin S.	B01D53/08	1/1
*	F	US-20180229182-A1	08-2018	Olson; Edwin S.	B01D53/10	1/1
*	G	US-20150246315-A1	09-2015	Olson; Edwin S.	B01J20/22	423/215.5
*	H	US-20170239644-A1	08-2017	Olson; Edwin S.	B01J20/3255	1/1
*	I	US-20180257031-A1	09-2018	Olson; Edwin S.	B01J20/3416	1/1
*	J	US-20150098878-A1	04-2015	Olson; Edwin S.	B01J20/12	423/210
*	K	US-9662629-B2	05-2017	Olson; Edwin S.	B01J20/12	1/1
*	L	US-20170173524-A1	06-2017	Olson; Edwin S.	B01J20/12	1/1
*	M	US-20180257030-A1	09-2018	Olson; Edwin S.	B01J20/0262	1/1

FOREIGN PATENT DOCUMENTS

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*	A	US-20090297413-A1	12-2009	Olson; Edwin S.	B01D53/10	423/215.5
*	B	US-8652235-B2	02-2014	Olson; Edwin S.	B01D53/10	95/142
*	C	US-20140099244-A1	04-2014	Olson; Edwin S.	B01D53/10	423/210
*	D	US-9468886-B2	10-2016	Olson; Edwin S.	B01D53/10	1/1
*	E	US-20170128908-A1	05-2017	Olson; Edwin S.	B01D53/10	1/1
*	F	US-20060048646-A1	03-2006	Olson; Edwin S.	B01D53/64	95/134
*	G	US-9757689-B2	09-2017	Olson; Edwin S.	B01J20/28016	1/1
*	H	US-6103205-A	08-2000	Wojtowicz; Marek A.	B01D53/04	423/210
*	I	US-4013516-A	03-1977	Greenfield; Charles	C10B47/30	201/2.5
*	J	US-4699896-A	10-1987	Sing; Kenneth S. W.	B01J21/18	264/29.2
*	K	US-8080088-B1	12-2011	Srinivasachar; Srivats	B01D53/02	502/417
*	L	US-20030104937-A1	06-2003	Sinha, Rabindra K.	B01D53/02	502/400
*	M	US-4500327-A	02-1985	Nishino; Hiroshi	B01D53/02	502/406

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U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-5556447-A	09-1996	Srinivasachar; Srivats	B09C1/06	588/256
*	B	US-7361209-B1	04-2008	Durham; Michael D.	B01D53/10	110/203
*	C	US-20070259781-A1	11-2007	Sinha; Rabindra K.	B01D53/77	502/400
*	D	US-20020114749-A1	08-2002	Cole, Jerald Alan	B01D53/64	423/210
*	E	US-20040244657-A1	12-2004	Srinivasachar, Srivats	B01D53/10	110/345
*	F	US-20030161771-A1	08-2003	Oehr, Klaus H.	B01D53/64	423/210
*	G	US-20030113239-A1	06-2003	Pahlman, John E.	B01D53/346	422/171
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
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CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO
Inventor Search (EAST)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	01/07/2019	AO
IDS Search (DAV and EAST)	08/17/2019	AO
IDS Search (DAV and EAST)	11/25/2019	AO

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	SEE EAST SEARCH HISTORY	09/09/2019	AO

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 2	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,471,412	11/12/2019	Olson, Edwin S, et al.
	US-20050274307A1	12/15/2005	Lissianski, Vitali Victor, et al.
	US-20190329179A1	10/31/2019	Olson, Edwin S., et al.
	US-20190329215A1	10/31/2019	Olson, Edwin S, et al.
	US-20190336913A1	11/7/2019	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 15/382,114, Response filed 10-3-19 to Final Office Action mailed 06-21-19", 23 pgs	
	"Application Serial No. 15/589,359, Corrected Notice of Allowability mailed 10-11-19", 2 pgs	
	"Application Serial No. 15/974,343, Corrected Notice of Allowability mailed 10-23-19", 2 pgs	
	"Application Serial No. 15/997,091, Corrected Notice of Allowability mailed 10-23-19", 3 pgs	
	"Application Serial No. 16/509,071, Response filed 10-3-2019 to Non Final Office Action mailed 09-11-19", 26 pgs.	
	"Application Serial No. 16/509,102, Non Final Office Action mailed 10-23-19", 26 pgs	
	"Application Serial No. 16/509,146, Non Final Office Action mailed 10-17-19", 24 pgs	
	"Ch. 35: Mercury, Hazardous Air Pollutants and other Multi-Pollutant Control", Tomei, G. L. (Ed.). Steam: its generation and use, Babcock and Wilcox Co., (2015), 24 pgs.	
	"Defendant's Answer and Counterclaim", Midwest Energy Emissions Corp., et al., v. Vistra Energy Corp., et al. - Case 1:19-cv-01334-RGA, 71 pgs.	
	"Original Complaint for Patent Infringement", Midwest Energy Emissions Corp., et al., v. Vistra Energy Corp., et al. - Case 1:19-cv-01334-UNA, 31 pgs.	
	"Plaintiff's Answer to Defendant's Counterclaims", Midwest Energy Emissions Corp., et al., v. Vistra Energy Corp., et al. - Case 1:19-cv-01334-RGA, 37 pgs.	
	OLSON, E.S., et al., "Chemical mechanisms in mercury emission control technologies", J. Phys. IV France 107, Proc. of the XIIth Intl. Conference on Heavy Metals in the Environment Volume II, pp. 979-982, (2003), 6 pgs.	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 11/25/2019

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 2 of 2	Attorney Docket No: 4820.001US9	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS		
Examiner Initial *	**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, page(s), volume-issue number(s), publisher, city and/or country where published.**	T1
	OLSON, EDWIN S., "Abstract - Multiple Site Model for Flue Gas - Mercury interactions on Activated Carbons: The Basic Site", Abstracts of Papers Part 1, 225th ACS National Meeting, New Orleans, LA, (2003), 3 pgs.	
	OLSON, EDWIN S., et al., "An Improved Model for Flue Gas - Mercury Interactions on Activated Carbons", Proceedings of the Combined Power Plant Air Pollutant Control Mega Symposium, (May 2003), 8 pgs.	
	OLSON, EDWIN, et al., "The Multiple Site Model for Flue Gas - Mercury Interactions on Activated Carbons: The Basic Site", Fuel Chemistry Preprints, 48(1), (2003), 3 pgs.	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 11/25/2019

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	45	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S2	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorben and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S3	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:20
S7	73	("20020150516" | "4786483" | "5409522" | "5505766" | "6383981" | "6878358" | "20020033097" | "4530765" | "5346674" | "6080281" | "4708853" | "6027551" | "6136072" | "6258334" | "6818043" | "20060057044" | "20080207443" | "20010002387" | "3826618" | "4814152" | "4820318" | "4889698" | "5891324" | "6528030" | "20050227146" | "5419834" | "7942566" | "20080134888" | "3662523" | "3849267" | "4196173" | "4500327" | "6942840" | "20020134242" | "20030136509" | "20050147549" | "20060112823" | "20080134888" | "6471936" | "20010003116" | "20050019240" | "20060048646" | "4956162" | "5575982" | "6372187" | "6375909" | "7435286" | "7514052" | "20050074380" | "20090081092" | "5288306" | "1984164" | "4101631" | "5695726" | "6080281" | "6848374" | "20050000197" | "5300137" | "5607496" | "5672323" | "6214304" | "6953494" | "5245120" | "20070168213" | "7938571" | "20040003716" | "20040013589" | "3194629" | "3786619" | "5827352" | "20040109800" | "20070295347" | "5435980" | "6136749" | "20030206846").PN.	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:25
S8	13	"11209163"	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S9	3	"11209163" and non carbon	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S10	161	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:49
S11	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50

		sorbent and promoter and activated carbond and mercury				
S12	116	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S13	172	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S14	67	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S15	67	"6136749"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:11
S16	20	"684374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S17	1	"20040003716"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S18	68	"6848374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S19	41	"7435286"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S20	13	"8168147"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S21	69	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S22	181	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S25	28	"5266280"	US-PGPUB; USPAT	ADJ	ON	2016/06/07 13:41
S26	281	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:01
S27	148	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:02
S28	159	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:18
S29	206	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2016/09/29 16:22

		activated carbon	EPO; JPO; DERWENT; IBM_TDB			
S30	195	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/09/30 13:48
S33	6	"20040003719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:56
S34	49	"2004003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:57
S35	81	"6848374"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:58
S36	56	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:02
S37	7	olson.in. and ("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:04
S38	0	("40" microns and halocarbon sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S39	0	(halocarbon sorbent).clm. and "40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S40	65	"40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2016/11/16 11:06

			DERWENT; IBM_TDB			
S41	3907	("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S42	29	("40" microns and sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S43	1	(halocarbon sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S44	36	(sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S45	0	(sorbent).clm. and olson.in. and "40" micron	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S46	17	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:09
S47	2	"20110233133"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:27
S48	7	"20110023427"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:28
S49	15	"2004025274"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2016/11/16 11:32

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S50	11	"20040025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S51	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S52	40	"6312489"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S53	30	("20030024872" | "20050045553" | "20050144916" | "4008060" | "4640779" | "4655921" | "4673503" | "4738778" | "4746432" | "4799944" | "5043000" | "5051118" | "5120296" | "5174896" | "5320657" | "5512075" | "5674302" | "6152979" | "6312489" | "6315130" | "6336946" | "6398836" | "6585793" | "6598749" | "7648546").PN. OR ("7931723").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:36
S54	33	("4200444" | "4640779" | "5968215" | "6059851").PN. OR ("6312489").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:40
S55	5	"8518142"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:54
S56	4	"8747505"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:57
S57	2	"14318270"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 12:06
S58	13	pac with size with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 12:13
S59	197	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/11/16 15:23
S60	0	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10,	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39

		B01D53/10).cpc. and (halogen or halide of HBr) with sorbent "4198388"				
S61	10	"4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S62	0	"2010083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S63	2	"20100083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S64	2	absorp$5 with mea with methanol with acid	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:36
S65	2	"20070283813"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:39
S66	21	"4469596"	US-PGPUB; USPAT	ADJ	ON	2016/11/21 08:29
S67	4	"2003229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S68	2	"20030229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S69	45	"5,338,458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S70	45	"5338458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S71	213	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:02
S72	64	("1786483" | "1984164" | "2317857" | "20010002387" | "20010003116" | "20020134242" | "20020150516" | "20030136509" | "20040003716" | "20040013589" | "20050019240" | "20060048646" | "20060191835" | "20090062119" | "20100047146" | "20120183458" | "20140056787" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "4196173" | "4500327" | "4814152" | "4820318" | "4889698" | "4959162" | "5300137" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" |	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:20

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S73	3	("20090235848" | "20110076210" | "20150246315").PN.	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:31
S79	3	("20090235848" | "20110076210" | "20140224121").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:36
S80	96	("1984164" | "2317857" | "20010002387" | "20010003116" | "20020043496" | "20020134242" | "20020150516" | "20030104937" | "20030136509" | "20040003716" | "20040013589" | "20040076570" | "20050019240" | "20060048646" | "20060191835" | "20080182747" | "20080292512" | "20090062119" | "20090136401" | "20090320678" | "20100047146" | "20110168018" | "20120183458" | "20130280156" | "20140056787" | "20140255279" | "20140308188" | "20150098878" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "3876393" | "4094777" | "4101631" | "4196173" | "4338896" | "4500327" | "4708853" | "4786483" | "4814152" | "4820318" | "4889698" | "4956162" | "5300137" | "5336835" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" | "5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6638485" | "6808692" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "6960329" | "7081434" | "7211707" | "7435286" | "7479263" | "7514052" | "7521032" | "7544338" | "7563311" | "7611564" | "7622092" | "7722843" | "7767174" | "7780765" | "8007749" | "8168147" | "8168149" | "8216535" | "8512655" | "8652235" | "8821819" | "9011805").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:41
S81	593	honeycomb with plug$4 and plug$4 with length	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S82	0	honeycomb with plug$4 and plug$4 with length with less than with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S83	0	honeycomb with plug$4 and plug$4 with length with less than	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S84	127	honeycomb with plug$4 and plug$4 with length with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:46
S85	241	honeycomb with plug$4 and plug$4 with length with mm	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:47
S86	41	honeycomb with plug$4 and plug$4 with	US-PGPUB;	ADJ	ON	2017/06/27

		length with "3 mm "	USPAT			14:49
S87	28	honeycomb with plug$4 and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:52
S88	28	honeycomb and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:53
S89	43	honeycomb and plug$4 with porosity with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:06
S90	20	honeycomb and plug$4 with pore (size or diameter) with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:07
S91	8	saw with honeycomb with filter	US-PGPUB; USPAT	ADJ	ON	2017/06/29 13:31
S92	230	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/12/01 14:36
S93	2	"20060260468"	US-PGPUB; USPAT	ADJ	ON	2018/07/03 10:34
S94	19	engine with air with inlet with filter$4 with cone	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:26
S95	36	engine with air with inlet with filter$4 with (cone or conical or (diameter with (increas$4 or decreas$4)))	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:27
S96	24	("3771638" | "3870495" | "3872012" | "4157902" | "4702754" | "5125940" | "5522909" | "5549724" | "5632793").PN. OR ("5888260").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S97	41	("0153535" | "0439091" | "1398685" | "1530163" | "1887052" | "2087688" | "4003836" | "4018580" | "4032455" | "4039308" | "4065276" | "4261710" | "4410341" | "4414110" | "4699715" | "5106397" | "5178656" | "5522909" | "5549722" | "5549724" | "5888260" | "6397842" | "6508052" | "D401597" | "D401942" | "D403414" | "D403416").PN. OR ("6808552").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S98	15	("D403416").URPN.	USPAT	ADJ	ON	2018/07/03 15:33
S99	0	"20030089233"	USPAT	ADJ	ON	2018/07/04 12:29
S100	3	"20030089233"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S101	26	"6833023"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S102	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:08
S103	14	carbocations with sorbent with bromine	US-PGPUB; USPAT;	ADJ	ON	2018/07/09 13:14

			USOCR; FPRS; EPO; JPO			
S104	0	a side forming a cross sectional shape of each of the first	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:47
S105	0	non of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S106	0	none of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S107	0	none of sides forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S109	13	olson.in. and (alkali and promoter and earth).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S110	0	olson.in. and (alkali and promoter and earth with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S111	10	olson.in. and (alkali and promoter with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S112	0	"2015008283"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S113	2	"20150082833"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S114	24	olson.in. and liquid.clm. and promoted	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:50
S115	75	remov$4 with mercury and (br or bromine) with liquid with carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:54
S116	0	separating greater than "70" wt% of the mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S117	0	((separating greater) with (of the mercury)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S118	20	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:43

S119	40	(during with after with mercury with sorbent)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:38
S120	304	sorbent with mercury and sorbent with boiler	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:39
S121	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:41
S122	18	before with burn$4 with coal with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:42
S123	204	("0174348" | "0202092" | "0208011" | "0224649" | "0229159" | "0298727" | "0346765" | "0347078" | "0367014" | "0537926" | "0537998" | "0541025" | "0625754" | "0647622" | "0685719" | "0688782" | "0700888" | "0744908" | "0846338" | "0894110" | "0896876" | "0911960" | "0945331" | "0945846" | "1112547" | "1167471" | "1167472" | "1183445" | "1788466" | "1984164" | "20020065581" | "20020114749" | "20020184817" | "20030088370" | "20030103882" | "20040003716" | "20040013589" | "20040086439" | "20040219083" | "20050039598" | "20060047526" | "20060210463" | "2016821" | "2059388" | "2089599" | "2511288" | "3194629" | "3288576" | "3437476" | "3599610" | "3662523" | "3725530" | "3764496" | "3823676" | "3838190" | "3849267" | "3849537" | "3956458" | "3961020" | "3974254" | "4040802" | "4075282" | "4094777" | "4101631" | "4115518" | "4148613" | "4174373" | "4196173" | "4226601" | "4233274" | "4272250" | "4280817" | "4305726" | "4322218" | "4377599" | "4387653" | "4394354" | "4440100" | "4472278" | "4474896" | "4519807" | "4519995" | "4555392" | "4582936" | "4602918" | "4629721" | "4693731" | "4716137" | "4741278" | "4758418" | "4764219" | "4786483" | "4804521" | "4807542" | "4824441" | "4830829" | "4873930" | "4886519" | "4892567" | "4915818" | "4933158" | "4936047" | "4964889" | "5013358" | "5024171" | "5049163" | "5116793" | "5126300" | "5137854" | "5162598" | "5190566" | "5238488" | "5350728" | "5368617" | "5409522" | "5435980" | "5447703" | "5460643" | "5505746" | "5505766" | "5571490").PN. OR ("5587003" |	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/01 17:42

		"5618508" | "5635150" | "5659100" | "5670122" | "5733516" | "5738834" | "5787823" | "5810910" | "5897688" | "5910292" | "5989506" | "6024931" | "6083289" | "6240859" | "6258334" | "6372187" | "6375909" | "6475451" | "6521021" | "6528030" | "6533842" | "6558454" | "6610263" | "6613110" | "6719828" | "6732055" | "6737031" | "6746531" | "6790420" | "6808692" | "6848374" | "6878358" | "6942840" | "6953494" | "6962617" | "6974564" | "6975975" | "7468170" | "7507083" | "7674442" | "7758827" | "7776301").PN.				
S124	1	"15573128"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:07
S125	2	"20110207597"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:08
S126	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S127	71	sorbent with before with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S128	234	"6953494"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:38
S129	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:40
S130	35	promoter with sorbent and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S131	28	promoter with sorbent with mercury and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S132	4	promoter with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:20
S133	4	promot$4 with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:23

S134	4	promot$4 with sorbent with mercury and pre.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:41
S135	2	promot$4 with sorbent with mercury and pre-heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:42
S136	2	promot$4 with sorbent with mercury and pre heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S137	57	promot$4 with sorbent with mercury and pre	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S138	24	sorbent with preheat$4 with coal	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:39
S139	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:47
S140	23	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:28
S141	5	"14102896"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:48
S142	7	"12429058"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:09
S143	4	"12202595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:23
S144	20	"12201595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:24
S145	3	"14564860"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:27

S146	1	"15978760"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:28
S147	1	"15589359"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:32
S148	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:37
S149	8	"15997091"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S150	6	"14712558"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S151	2	"15951970"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:18
S152	4	"15382114"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:47
S153	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:51
S154	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:18
S155	69	"4279873"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:42
S156	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 07:59
S157	4	"15295594"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 08:08

S158	1	("20180257030").PN.	US-PGPUB; USPAT	ADJ	ON	2018/10/04 09:31
S159	86	"5569436"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:32
S160	6	"5785935"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S161	8	"6475471"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S162	53	"6103205"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:46
S163	0	pyrolysis with char with mercury with activated	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S164	17	pyrolysis with char with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S165	121	pyrolysis with char with activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S166	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S167	43	pyrolysis with char with activated carbon and mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S168	118	pyrolysis with char with tire	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S169	58	pyrolysis with char with activated carbon and mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S170	8	"20040081724"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2018/10/04 15:07

			FPRS; EPO; JPO			
S171	4	"14128179"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 15:10
S172	84	activat$4 carbon with boiler with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S173	88	activat$4 carbon with boiler with coal and (remov$4 or filter$4 or absorb$4 or adsorb$4) with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S174	0	mercury with stabiliz$4 with sulfer dioxide	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 14:23
S175	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 15:07
S176	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:48
S177	17	"8821819"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:51
S178	15	"8652235"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:55
S179	93	"6136749"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/24 09:08
S180	4	"9757689"	US-PGPUB; USPAT	ADJ	ON	2018/10/24 12:37
S181	9	"8939388"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 09:59
S182	669	urea with inject$4 with filter$4 with exhaust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:15

S183	2	urea with inject$4 with filter$4 with exhaust and urea with quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:16
S184	13	"3615165"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:35
S185	136	urea with quench$4 with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:39
S186	48	urea dust with scrub$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 11:25
S187	38	"6221155"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 12:04
S188	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 14:12
S189	773	ammonium with remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:14
S190	108	ammonium with salt with remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:15
S191	45	ammonium with salt with remov$4 with mercury and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:15
S192	42	"5556447"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:21
S193	174	"4500327"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:21
S194	72	"4500327" and ammonium	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:23

S195	3	anionic couterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S196	3480	anionic counterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S197	2422	anionic counterion and ammonium with salt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S198	9	anionic counterion and ammonium with salt and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S199	52	"6960329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:50
S200	4	"20040003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/06 11:23
S201	1	"45219176".FMID.	US-PGPUB; USPAT; FPRS	ADJ	ON	2018/12/06 13:32
S202	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/01/07 09:41
S203	284	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/04/15 14:29
S204	88	activat$4 carbon with boiler with coal and (remov$4 or filter$4 or absorb$4 or adsorb$4) with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/04/15 14:29
S205	42	"6132790"	US-PGPUB; USPAT	ADJ	ON	2019/06/12 16:06
S206	19	remov$4 with mercury and calcium nitrate with sorbent	US-PGPUB; USPAT	ADJ	ON	2019/06/12 16:55
S207	1	remov$4 with mercury with calcium nitrate	US-PGPUB; USPAT	ADJ	ON	2019/06/12 16:57
S208	1	"20040146613"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2019/06/13 12:59

			FPRS; EPO; JPO			
S209	71	("6372187").URPN.	USPAT	ADJ	ON	2019/06/18 10:24
S210	48	("6372187").URPN. and (iodide or HI)	USPAT	ADJ	ON	2019/06/18 10:25
S211	61	(iodide or HI) with inject$4 and mercury with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/18 10:30
S212	85	(iodide or HI) with coal and mercury with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/18 10:35
S213	131	"6558454"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/18 10:41
S214	5	"15295594"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 12:48
S215	82	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 16:29
S216	65	"4013516"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 21:01
S217	24	"4699896"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 21:01
S218	2	"20120100053"	US-PGPUB; USPAT	ADJ	ON	2019/08/17 11:40
S219	1	"20130157845"	US-PGPUB; USPAT	ADJ	ON	2019/08/17 11:40
S220	204	coal with combust$4 and sorbent with (iodine or iodide or HI)	US-PGPUB; USPAT	ADJ	ON	2019/09/04 12:15
S221	184	coal with combust$4 and sorbent with (iodine or HI)	US-PGPUB; USPAT	ADJ	ON	2019/09/04 12:18
S222	184	coal with combust$4 and sorbent with (iodine or HI) and (iodine or HI)	US-PGPUB; USPAT	ADJ	ON	2019/09/04 12:20
S223	0	electric utility coal combustion chamber	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 14:06
S224	12	electric with coal combustion chamber	US-PGPUB; USPAT;	ADJ	ON	2019/09/04 14:07

			USOCR; FPRS; EPO; JPO			
S225	1755	electric with coal with combustion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 14:08
S226	219	electric with coal with combustion with chamber	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 14:09
S227	89	electric with coal with combustion with chamber	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/09/04 14:09
S228	20	subbituminous with coal with chamber	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 19:42
S229	191	subbituminous with coal with combustion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 19:43
S230	1009	lignite with coal with combustion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 20:09
S231	0	lignite with coal with combustion and mercury with sorbet	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 20:10
S232	54	lignite with coal with combustion and mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/04 20:10
S233	4	"14917980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/05 12:48
S234	246	"6878358"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/05 13:31
S250	25	"2012035853"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/09/19 14:19

11/ 25/ 2019 2:39:55 PM
C:\ Users\ amillerharris\ Documents\ EAST\ Workspaces\ 12429058.wsp

Bibliographic Data

Application No: 15/974,343

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /AMBER R ORLANDO/ Examiner's Signature | Initials

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/08/2018	095	1776	4820.001US9
RULE			

APPLICANTS

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CONTINUING DATA

This application is a CON of 15951970 04/12/2018

15951970 is a CON of 14712558 05/14/2015

14712558 is a CON of 14318270 06/27/2014 PAT 9757689

14318270 is a CON of 13966768 08/14/2013 PAT 8821819

13966768 is a CON of 13427665 03/22/2012 PAT 8512655

13427665 is a CON of 12419219 04/06/2009 PAT 8168147

12419219 is a CON of 12201595 08/29/2008ABN

12201595 is a CON of 11209163 08/22/2005 PAT 7435286

11209163 has PRO of 60605640 08/30/2004

FOREIGN APPLICATIONS

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06/05/2018

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UNITED STATES

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 11/21/2019

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
11/21/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 15/974,343	**Applicant(s)** Olson et al.	
	Examiner CHERYL P GIBSON BAYLOR	**Art Unit** OPET	**AIA (FITF) Status** No

1. THE REQUEST FILED 11 November 2019 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☐ for an original nonprovisional application (Track I).
B. ☑ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to CHERYL GIBSON BAYLOR at (571)272-3213. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/CHERYL GIBSON BAYLOR/ Paralegal Specialist, OPET	

Doc Code: TRACK1.REQ
Document Description: TrackOne Request

Modified PTO/AIA/424 (04-14)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e)

(Page 1 of 1)

First Named Inventor:	Edwin S. Olson	Nonprovisional Application Number (if known):	15/974,343
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	Docket No.:	4820.001US9

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. **Request for Continued Examination – Prioritized Examination under § 1.102(e)(2)**

   i. A request for continued examination has been filed with, or prior to, this form.
   ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
   iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C 371.
   iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
   v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Nicholas P. Lanzatella/	Date November 11, 2019
Name (Print/Typed) Nicholas P. Lanzatella	Practitioner Registration Number: 63,803

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

*Total of 1 forms are submitted.

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Janal M. Kalis/Megan Reed
Attorney Docket Number:	4820.001US9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
Miscellaneous-Filing:				
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
RCE- 2ND AND SUBSEQUENT REQUEST	1820	1	1900	1900
		Total in USD ($)		**6280**

Electronic Acknowledgement Receipt

EFS ID:	37715323
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Janal M. Kalis/Megan Reed
Filer Authorized By:	Janal M. Kalis
Attorney Docket Number:	4820.001US9
Receipt Date:	11-NOV-2019
Filing Date:	08-MAY-2018
Time Stamp:	16:16:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$6280
RAM confirmation Number	E2019AAG17138084
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		_SIGNED_4820_001US9_RCE_QPIDS_Track1.pdf	287285 2f64de740fc2d38d1e79e25cadb6e7aa39a1bedc	yes	5
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Request for Continued Examination (RCE)		1	1	
	Information Disclosure Statement (IDS) Form (SB08)		2	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	4	
	TrackOne Request		5	5	
Warnings:					
Information:					
2	Non Patent Literature	0001_2_npl_4820001u10_cnoa_10232019_f.pdf	106645 40fe9bc6f63485b76577b5b45e0e496f352e03ed	no	3
Warnings:					
Information:					
3	Non Patent Literature	0002_2_npl_4820001u11_nonfinalofficeactionresponseprioritized_f.pdf	526929 04b215c7f323c8478d91a0b44aa00bb36b79ec24	no	26
Warnings:					
Information:					
4	Non Patent Literature	0003_2_npl_4820001u12_oarnpe_10232019_f.pdf	1143427 1bc491111281f43813c00645c63055c2acc784b01	no	26
Warnings:					
Information:					

5	Non Patent Literature	0004_2_npl_4820001us9_cnoa_10232019_f.pdf	101253 ac49c65c6e93f3d80fe1241a7267bbe4ce6e1eb2	no	2
Warnings:					
Information:					
6	Non Patent Literature	0005_2_npl_4820003us2_cnoa_10112019_f.pdf	101037 c000997b186ca7df00d697179b70f9f9c3cc2549	no	2
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_4820004us1_amendmentresponsefinalofficeaction_f.pdf	484739 e1293ff944e8cd3c23666bb4b97a2b9158df0bcb	no	23
Warnings:					
Information:					
8	Non Patent Literature	0007_2_npl_4820007us5_oarn_10172019_f.pdf	1057697 14423c067c4d4979405cd54d9c930d5c463c5112	no	24
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_me2c_aep_answer_counterclaim_10092019_f.pdf	472359 a2d354a5a8e9e13d916189c978754ee488f11076	no	71
Warnings:					
Information:					
10	Non Patent Literature	0009_2_npl_me2c_aep_plaintiff_answer_10302019_f.pdf	359806 0f825925d9fe977d4795eadac3a3355f698c86e7	no	37
Warnings:					
Information:					
11	Non Patent Literature	0010_2_npl_me2c_vistra_complaint_07172019_f.pdf	233926 ce228a65787182c1de71fb90b0079b29321ac78	no	31
Warnings:					
Information:					

12	Non Patent Literature	0011_2_npl_olson_chemicalmechanisms_2003_f.pdf	3555311 bd3960470ae79785829e217ef1c4f46da2973f94	no	6
Warnings:					
Information:					
13	Non Patent Literature	0012_2_npl_olson_improvedmodel_2003_f.pdf	710676 e4583ff2d36eefb80ae4ca83f48310b3e07004db	no	8
Warnings:					
Information:					
14	Non Patent Literature	0013_2_npl_olson_multiplesite_2003_f.pdf	503809 f844bbb05f108e0c52b30989d81a3c781eec537c	no	3
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
15	Non Patent Literature	0014_2_npl_olson_multiplesite_abstract_2003_f.pdf	1478989 c989216ff7859843db48dd193df0ced38e9f1a2b	no	3
Warnings:					
Information:					
16	Non Patent Literature	0015_2_npl_steam_42_ch_35_2015_f.pdf	4031937 b9d944c4bc03fa307702d1b558af7437dc9ecb94	no	24
Warnings:					
Information:					
17	Fee Worksheet (SB06)	fee-info.pdf	35561 84fc76f6c05bc206390ca8bdb228d0c0f69b77d9	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	15191386		

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.

CERTIFICATION AND REQUEST FOR CONSIDERATION OF AN INFORMATION DISCLOSURE STATEMENT FILED AFTER PAYMENT OF THE ISSUE FEE UNDER THE QPIDS PILOT PROGRAM

Non-Provisional Application No. 15/974,343	Filing date: May 8, 2018

First Named Inventor: Edwin S. Olson et al.

Title of Invention: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

THE UNDERSIGNED HEREBY CERTIFIES AND REQUESTS THE FOLLOWING FOR THE ABOVEIDENTIFIED APPLICATION.

1. Consideration is requested of the information disclosure statement (IDS) submitted herewith, which is being filed after payment of the issue fee.

2. Check the box next to the appropriate selection:

☐ Each item of information contained in the IDS 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 IDS. See 37 CFR 1.97(e)(1).

OR

☒ No item of information contained in the IDS 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 IDS was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the IDS. See 37 CFR 1.97(e)(2).

OR

☐ See attached certification statement in compliance with 37 CFR 1.97(e).

3. Please charge the IDS fee set forth in 37 CFR 1.17(p) to Deposit Account No. 19-0743..

4. A Petition to Withdraw from Issue After Payment of the Issue Fee (37 CFR 1.313(c)(2)), including the petition fee set forth in 37 CFR 1.17(h), is submitted herewith as a **Web-based ePetition**.
WARNING: Do not submit the petition as a follow-on paper via EFS-Web. Submit the petition as a Webbased ePetition by signing on to EFS-Web as a registered user, selecting the radio button next to "Existing application/patent," and then selecting the radio button next to "ePetition (for automatic processing and immediate grant, if all petitions requirements are met)." Failure to use the Web-based ePetition interface will result in automatic entry of the RCE.

5. A request for continued examination (RCE) under 37 CFR 1.114 and the RCE fee under 37 CFR 1.17(e) are submitted herewith.

6. The RCE will be treated as a "conditional" RCE. In the event the examiner determines that any item of information contained in the IDS necessitates the reopening of prosecution in the application, the undersigned understands that (i) the RCE will be processed and treated as an RCE under 37 CFR 1.114 and therefore (ii) the IDS fee under 37 CFR 1.17(p) will be returned in accordance with 37 CFR 1.97(b)(4). In the event that no item of information in the IDS necessitates reopening prosecution, the undersigned understands that the RCE will not be processed and the RCE fee under 37 CFR 1.17(e) will be returned.

7. This certification and request is being filed as a **Web-based ePetition** and is not accompanied by an amendment to the application. Inclusion of an amendment will result in automatic entry of the RCE.

Signature	Date
/Nicholas P. Lanzatella/	November 11, 2019
Name (Print/Typed) Nicholas P. Lanzatella	Practitioner Registration Number (If applicable) 63,803

Note: *Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required in accordance with 37 CFR 1.33 and 11.18. Please see 37 CFR 1.4(d) for the form of the signature. If necessary, submit multiple forms for more than one signature, see below.**

☒ *Total of ___1___ form is submitted.

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL	*Application Number*	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Confirmation Number	1072
	Group Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9
	Customer No.	21186

This is a Request for Continued Examination (RCE) under 37 C.F.R § 1.114 of the above-identified application entitled
SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

1. Submission required under 37 C.F.R. § 1.114:

   X Petition to Withdraw from Issue under 37 CFR 1.313(c)(2) submitted as a web-based ePetition via EFS-Web.

   X Certification And Request For Consideration Of An Information Disclosure Statement Filed After Payment Of The Issue Fee Under The QPIDS Pilot Program (1 page), Form 1449 (2 page), and copies of cited documents (15).

   X Certification And Request For Prioritized Examination (Track 1) (1 pg.)

2. Fees

   X Subject to the conditions of the QPIDS Pilot Program as stated above: Authorization to charge deposit account 19-0743 in the amount of $1900.00 to pay the subsequent RCE filing fee required under 37 C.F.R. § 1.17(e)(2).

   X Authorization to charge deposit account 19-0743 in the amount of $240.00 to pay the fee for IDS submission required under 37 C.F.R. § 1.17(p).

   X Authorization to charge deposit account 19-0743 in the amount of $140.00 for the fee under 37 CFR 1.17(h).

   X Authorization to charge deposit account 19-0743 in the amount of $4000.00 for the Prioritized Examination (Track 1) filing fee as set forth in 37 C.F.R. § 1.17(c); and Authorization to charge Deposit Account 19-0743 for the Processing Fee (Track 1) set forth in 37 C.F.R. § 1.17(i) in the amount of $140.00.

The Commissioner is hereby authorized to charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 2	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,471,412	11/12/2019	Olson, Edwin S, et al.
	US-20050274307A1	12/15/2005	Lissianski, Vitali Victor, et al.
	US-20190329179A1	10/31/2019	Olson, Edwin S., et al.
	US-20190329215A1	10/31/2019	Olson, Edwin S, et al.
	US-20190336913A1	11/7/2019	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 15/382,114, Response filed 10-3-19 to Final Office Action mailed 06-21-19", 23 pgs	
	"Application Serial No. 15/589,359, Corrected Notice of Allowability mailed 10-11-19", 2 pgs	
	"Application Serial No. 15/974,343, Corrected Notice of Allowability mailed 10-23-19", 2 pgs	
	"Application Serial No. 15/997,091, Corrected Notice of Allowability mailed 10-23-19", 3 pgs	
	"Application Serial No. 16/509,071, Response filed 10-3-2019 to Non Final Office Action mailed 09-11-19", 26 pgs.	
	"Application Serial No. 16/509,102, Non Final Office Action mailed 10-23-19", 26 pgs	
	"Application Serial No. 16/509,146, Non Final Office Action mailed 10-17-19", 24 pgs	
	"Ch. 35: Mercury, Hazardous Air Pollutants and other Multi-Pollutant Control", Tomei, G. L. (Ed.). Steam: its generation and use, Babcock and Wilcox Co., (2015), 24 pgs.	
	"Defendant's Answer and Counterclaim", Midwest Energy Emissions Corp., et al., v. Vistra Energy Corp., et al. - Case 1:19-cv-01334-RGA, 71 pgs.	
	"Original Complaint for Patent Infringement", Midwest Energy Emissions Corp., et al., v. Vistra Energy Corp., et al. - Case 1:19-cv-01334-UNA, 31 pgs.	
	"Plaintiff's Answer to Defendant's Counterclaims", Midwest Energy Emissions Corp., et al., v. Vistra Energy Corp., et al. - Case 1:19-cv-01334-RGA, 37 pgs.	
	OLSON, E.S., et al., "Chemical mechanisms in mercury emission control technologies", J. Phys. IV France 107, Proc. of the XIIth Intl. Conference on Heavy Metals in the Environment Volume II, pp. 979-982, (2003), 6 pgs.	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 2 of 2	Attorney Docket No: 4820.001US9	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS		
Examiner Initial *	**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, page(s), volume-issue number(s), publisher, city and/or country where published.**	T1
	OLSON, EDWIN S., "Abstract - Multiple Site Model for Flue Gas - Mercury interactions on Activated Carbons: The Basic Site", Abstracts of Papers Part 1, 225th ACS National Meeting, New Orleans, LA, (2003), 3 pgs.	
	OLSON, EDWIN S., et al., "An Improved Model for Flue Gas - Mercury Interactions on Activated Carbons", Proceedings of the Combined Power Plant Air Pollutant Control Mega Symposium, (May 2003), 8 pgs.	
	OLSON, EDWIN, et al., "The Multiple Site Model for Flue Gas - Mercury Interactions on Activated Carbons: The Basic Site", Fuel Chemistry Preprints, 48(1), (2003), 3 pgs.	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/140 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**PETITION TO WITHDRAW AN APPLICATION FROM ISSUE AFTER PAYMENT OF THE ISSUE FEE UNDER 37 CFR 1.313(c)**
Application Number	15974343
Filing Date	08-May-2018
First Named Inventor	Edwin Olson
Art Unit	1776
Examiner Name	AMBER ORLANDO
Attorney Docket Number	4820.001US9
Title	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

An application may be withdrawn from issue for further action upon petition by the applicant. To request that the Office withdraw an application from issue, applicant must file a petition under this section including the fee set forth in § 1.17(h) and a showing of good and sufficient reasons why withdrawal of the application from issue is necessary.

APPLICANT HEREBY PETITIONS TO WITHDRAW THIS APPLICATION FROM ISSUE UNDER 37 CFR 1.313(c).

A grantable petition requires the following items:
(1) Petition fee; and
(2) One of the following reasons:
(a) Unpatentability of one or more claims, which must be accompanied by an unequivocal statement that one or more claims are unpatentable, an amendment to such claim or claims, and an explanation as to how the amendment causes such claim or claims to be patentable;
(b) Consideration of a request for continued examination in compliance with § 1.114 (for a utility or plant application only); or
(c) Express abandonment of the application. Such express abandonment may be in favor of a continuing application, but not a CPA under 37 CFR 1.53(d).

Petition Fee

- ○ Small Entity
- ○ Micro Entity
- ◉ Regular Undiscounted

Reason for withdrawal from issue

○ One or more claims are unpatentable	
◉ Consideration of a request for continued examination (RCE) (List of Required Documents and Fees)	
○ Applicant hereby expressly abandons the instant application (any attorney/agent signing for this reason must have power of attorney pursuant to 37 CFR 1.32(b)).	
RCE request,submission, and fee.	
☒ I certify, in accordance with 37 CFR 1.4(d)(4) that : The RCE request ,submission, and fee have already been filed in the above-identified application on 2019.07.11	
☐ Are attached.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES	
I certify, in accordance with 37 CFR 1.4(d)(4) that I am:	
◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.	
○ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity.	
○ A sole inventor	
○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application	
○ A joint inventor; all of whom are signing this e-petition	
Signature	/Nicholas P. Lanzatella/
Name	Nicholas P. Lanzatella
Registration Number	63803

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Janal M. Kalis/Megan Reed
Attorney Docket Number:	4820.001US9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
PETITION FEE- 37 CFR 1.17(H) (GROUP III)	1464	1	140	140
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**140**

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Alexandria, VA 22313-1450
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Decision Date : November 11, 2019

In re Application of :

Edwin Olson

DECISION ON PETITION

UNDER CFR 1.313(c)(2)

Application No : 15974343

Filed : 08-May-2018

Attorney Docket No : 4820.001US9

This is an electronic decision on the petition under 37 CFR 1.313(c)(2), filed November 11, 2019 to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED.**

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). See 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid in this application cannot be refunded. If, however, this application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being referred to Technology Center AU 1776 for processing of the request for continuing examination under 37 CFR 1.114 .

Office of Petitions

Electronic Acknowledgement Receipt

EFS ID:	37715287
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Janal M. Kalis/Megan Reed
Filer Authorized By:	Janal M. Kalis
Attorney Docket Number:	4820.001US9
Receipt Date:	11-NOV-2019
Filing Date:	08-MAY-2018
Time Stamp:	16:16:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$140
RAM confirmation Number	E2019AAG15578067
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	31716 1f26dcf5d16807258bc04080f1b2f613b73eb085	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30601 6355ee5599861cbc3ab2a9f273fb577cf1c12c11	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	62317		

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.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 10/23/2019

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
10/23/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

CORRECTED ***Notice of Allowability***	**Application No.** 15/974,343	**Applicant(s)** Olson et al.	
	Examiner AMBER R ORLANDO	**Art Unit** 1776	**AIA (FITF) 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 the IDS filed 09/13/2019.
   ☐ 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 27-55 . 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 _____.

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20190009247A1	1/10/2019	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-19-18", 28 pgs	
	"Application Serial No. 14/712,558, Final Office Action mailed 01-11-19", 27 pgs	
	"Application Serial No. 15/382,114, Non Final Office Action mailed 12-12-18", 46 pgs	
	"Application Serial No. 15/589,359, Amendment and Response filed 01-17-19 to Non Final Office Action mailed 10-22-18", 14 pgs	
	"Application Serial No. 15/978,760, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-10-18", 25 pgs	
	"Application Serial No. 15/978,760, Final Office Action mailed 12-26-18", 21 pgs	
	"Application Serial No. 15/997,091, Final Office Action mailed 01-11-19", 20 pgs	
	"Application Serial No. 15/997,091, Response filed 12-03-18 to Non Final Office Action mailed 11-02-18", 40 pgs.	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 10/12/2019

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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	5556447		1996-09-17	Srinivasachar, Srivats, et al.	
	2	7361209		2008-04-22	Durham, Michael D, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020114749	A1	2002-08-22	Cole, Jerald Alan	
	2	20030113239	A1	2003-06-19	Pahlman, John E, et al.	
	3	20030161771	A1	2003-08-28	Oehr, Klaus H	
	4	20040244657	A1	2004-12-09	Srinivasachar, Srivats, et al.	

/AMBER R ORLANDO/ 10/12/2019

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

	5	20070259781	A1	2007-11-08	Sinha, Rabindra K		
	6	20140099244	A1	2014-04-10	Olson, Edwin S, et al.		

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

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]
	1	"Application Serial No. 16/509,071, Non Final Office Action mailed 09-11-19", 21 pgs.	
	2	"Application Serial No. 14/712,558, Non Final Office Action mailed 09-12-19", 15 pgs.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/AMBER R ORLANDO/	Date Considered	10/12/2019

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

[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.

/AMBER R ORLANDO/ 10/12/2019

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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	/Nicholas P. Lanzatella.	Date (YYYY-MM-DD)	2019-09-13
Name/Print	Nicholas P. Lanzatella	Registration Number	63,803

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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/974,343	05/08/2018	1776	2620	4820.001US9	16	1

CONFIRMATION NO. 1072

CORRECTED FILING RECEIPT

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

Date Mailed: 10/02/2019

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Edwin S. Olson, Grand Forks, ND;
Michael J. Holmes, Thompson, ND;
John H. Pavlish, East Grand Forks, MN;

Applicant(s)

Midwest Energy Emissions Corp., Lewis Center, OH;

Power of Attorney: The patent practitioners associated with Customer Number 21186

Domestic Priority data as claimed by applicant

This application is a CON of 15/951,970 04/12/2018
which is a CON of 14/712,558 05/14/2015
which is a CON of 14/318,270 06/27/2014 PAT 9757689
which is a CON of 13/966,768 08/14/2013 PAT 8821819
which is a CON of 13/427,665 03/22/2012 PAT 8512655
which is a CON of 12/419,219 04/06/2009 PAT 8168147
which is a CON of 12/201,595 08/29/2008 ABN
which is a CON of 11/209,163 08/22/2005 PAT 7435286
which claims benefit of 60/605,640 08/30/2004

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.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/05/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/974,343**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Preliminary Class

423

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor

community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION RE: UPDATE TO APPLICATION DATA SHEET

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

Applicants hereby request that the information provided on the Application Data Sheet filed in the above-referenced application on May 8, 2018, be updated with the information as provided on the enclosed marked up Application Data Sheet.

We therefore submit a marked up copy of the Application Data Sheet which shows an update to the Applicant Information and the Domestic Benefit/National Stage Information.

Once this request is entered, it is respectfully requested that the USPTO update their records and provide confirmation of the above request by way of an Updated Filing Receipt.

It is believed that no fee is required to fulfill this request, however, if necessary, please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

Schwegman Lundberg & Woessner, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 09/27/2019 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

Amended PTO/AIA/01 (06-12)
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 displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 15/974,343, filed on May 8, 2018 .

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 (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: John H. Pavlish Date (Optional): 9-27-2019

Signature: John H Pavlish

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

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1.11 and 1.14. This collection is estimated to take 1 minute 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION RE: LATE SUBMISSION OF DECLARATION

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

In compliance with 37 CFR 1.63, we submit the Signed Declaration. Corresponding fees with regard to the late submission were paid with the filing of the application on May 8, 2018 therefore applicants believe no additional fees are due at this time.

Applicants assume the application is now in proper order and in condition for allowance. Please direct any inquiries to the undersigned at (612) 349-9580. If necessary, please charge any additional fees or credit overpayment to Deposit Account 19-0743.

Respectfully submitted,

Schwegman Lundberg & Woessner, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 09/27/2019 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

NPL:CMG:dnj

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket No.:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION RE: FEE ADDRESS

Mail Stop Issue Fee
Commissioner for Patents
P.O.Box 1450
Alexandria, VA 22313-1450

In response to the Notice of Allowance and Issue Fee Due, please record the Fee Address under the provisions of 37 CFR 1.363 as the following:

Customer Number 21186

Please direct any inquiries to the undersigned attorney at (612) 349-9580.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 09/27/2019

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:CMG:dmj

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

21186 7590 09/17/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

TITLE OF INVENTION: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	12/17/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
ORLANDO, AMBER ROSE	1776	423-210000

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 03-09 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 Schwegman Lundberg
2 & Woessner, P.A.
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Midwest Energy Emissions Corp.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Lewis Center, OH

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

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 19-0743

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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.
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.
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 /Nicholas P. Lanzatella/ Date 09/27/2019

Typed or printed name Nicholas P. Lanzatella Registration No. 63,803

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PAC ET AL. EXHIBIT 1019
Page 173

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	December 17, 2019
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the attached:

X Authorization to charge Deposit 19-0743 in the amount of $1,000.00 to cover the Large Entity Issue Fee Payment.
X Issue Fee Transmittal (Form PTOL-85).
X Communication Re: Fee Address (1 page).
X Communication Re: Late Submission of Declaration (1 pg.).
X Signed Declaration (1 pg.).
X Communication Re: Update to Application Data Sheet (1 Pg.).
X Marked Up Application Data Sheet (6 Pgs.).
X Statement Under 37 CFR 3.73 (c) (2 pgs.)
X Copy of Signed Assignment (20 pgs.)

It is believed that no additional fee is required. However, if necessary, please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

Schwegman Lundberg & Woessner, P.A.
Customer No: 21186
NPL:CMG:dmj

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being transmitted using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 27th day of September, 2019.

Diana Johnson
Name

/Diana Johnson/
Signature

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	James Lee Shands/Diana Johnson
Attorney Docket Number:	4820.001US9

Filed as Large 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	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt

EFS ID:	37303175
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	James Lee Shands/Diana Johnson
Filer Authorized By:	James Lee Shands
Attorney Docket Number:	4820.001US9
Receipt Date:	27-SEP-2019
Filing Date:	08-MAY-2018
Time Stamp:	15:15:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	E20199QF16384985
Deposit Account	190743
Authorized User	Diana Johnson

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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		4820001US9IssuefeeUADSDecSigned.pdf	18385717 88df3dc6949fac1f1da6286c5d5119555191fed9	yes	35

Multipart Description/PDF files in .zip description

Document Description	Start	End
Miscellaneous Incoming Letter	15	35
Assignee showing of ownership per 37 CFR 3.73	13	14
Application Data Sheet	7	12
Request for Corrected Filing Receipt	6	6
Oath or Declaration filed	5	5
Miscellaneous Incoming Letter	4	4
Miscellaneous Incoming Letter	3	3
Issue Fee Payment (PTO-85B)	2	2
Transmittal Letter	1	1

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30340 84f93599797404a5824068a76f28d4f922913f39	no	2

Warnings:

Information:

Total Files Size (in bytes):	18416057

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.

CONFIRMATORY ASSIGNMENT

THIS CONFIRMATORY ASSIGNMENT is made by Edwin S. Olson residing at 223 Cedar Hills Dr, Grand Forks, ND 58201 ("Assignor"), to Energy and Environmental Research Center Foundation, a North Dakota nonprofit corporation having a business address of 15 N. 23rd Street, Stop 9018, Grand Forks, North Dakota, 58202-9018 ("Assignee") and is effective as of the date this Confirmatory Assignment is executed by Assignor.

WHEREAS, Assignor has invented the inventions disclosed in the patents and patent applications listed in Exhibit A attached (collectively, and including all such inventions and all patents and patent applications for such inventions that have now been, or may in the future be, filed and/or granted for such inventions, including without limitation those patents and patent applications listed in Exhibit A, "Inventions") and, for good and valuable consideration, has agreed to assign, and has assigned, all of Assignor's right, title and interest in and to the Inventions to Assignee; and

WHEREAS, Assignor desires to confirm and assure the assignment, sale and transfer to Assignee of any and all right, title, and interest Assignor has in the Inventions; and

WHEREAS, this Confirmatory Assignment confirms that all Inventions listed in Exhibit A belong exclusively to Assignee and that Assignor has assigned, sold and transferred to Assignee, and hereby further assigns, sells and transfers to Assignee, without any requirement of further consideration, the entire right, title and interest in and to the Inventions, in the United States and its territorial possessions, and in all foreign countries, including without limitation all rights to claim priority in and to any and all improvements which are disclosed in the Inventions, and that upon the request of the Assignee, Assignor will take such further actions, including without limitation execution and delivery of instruments of conveyance, as may be appropriate to give full and proper effect to such assignment.

NOW THEREFORE, in consideration of the foregoing premises, the sum of Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor hereby assigns, sells and transfers to Assignee Assignor's entire right, title and interest in and to the Inventions, in the United States and its territorial possessions, and in all foreign countries, including without limitation: (1) all rights to claim priority in and to the Inventions and/or any and all improvements which are disclosed in the Inventions; (2) all rights with respect to the Inventions, including all United States patents and/or other

PAC ET AL. EXHIBIT 1019
Page 180

governmental grants and/or issuances that may be granted with respect to the Inventions and/or from any direct and/or indirect divisionals, continuations, continuations-in-part and/or other patent applications claiming priority rights from the Inventions; (3) all reissues, reexaminations, extensions and/or registrations of the foregoing; (4) all non-United States patents, patent applications and/or counterparts relating to the foregoing, including without limitation certificates of invention, utility models, industrial design protection, design patent protection and other governmental grants and/or issuances, and including the right to file United States and/or foreign applications directly in the name of Assignee, its successors and assigns; (5) all causes of action and/or remedies related to the foregoing (including without limitation, the right to sue for past, present and/or future infringement, misappropriation and/or violation of rights related to any of the foregoing and the right to collect royalties and/or other payments under or on account of any of the foregoing); and, (6) any and all other rights and/or interests arising out of, in connection with and/or in relation to the foregoing.

Assignor hereby covenants that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this Confirmatory Assignment.

Assignor agrees now, and at any time and from time to time in the future, upon request of Assignee, Assignee's successors, legal representatives and/or assigns, and at Assignee's expense, to take, execute, acknowledge, and deliver all such further acts and deeds, assignments, instruments of transfer or conveyance, registrations for assignments, powers of attorney, declarations and/or assurances as may be required for the assigning, selling, transferring, assuring and confirming to Assignee, and Assignee's successors and assigns, and/or for aiding and assisting in collecting and reducing to possession, the rights assigned, sold and transferred under this Confirmatory Assignment, to participate in proceedings regarding such rights (including without limitation, any litigation and/or patent office proceedings) and/or to or perfect and/or defend title to such rights.

Assignor requests the respective patent office or governmental agency in each jurisdiction to issue any and all patents, certificates of invention, utility models and/or other governmental grants and/or issuances that may be granted upon the rights assigned, sold and transferred under this Confirmatory Assignment in the name of the Assignee, as the assignee to the entire interest therein.

The terms and conditions of this Confirmatory Assignment will inure to the benefit of Assignee, and Assignee's successors, legal representatives and assigns, and will be binding upon Assignor, and Assignor's successors, legal representatives and assigns.

By: _____
(Edwin S. Olson, *Signature MUST be attested*)

ATTESTATION

ATTESTATION OF SIGNATURE PURSUANT TO 28 U.S.C. 1746

The undersigned witnessed the signature of Edwin S. Olson to the above Confirmatory Assignment and makes the following statements:

1. I am over the age of 18 and competent to testify as to the facts in this Attestation block if called upon to do so.

2. Edwin S. Olson is personally known to me (or proved to me on the basis of satisfactory evidence) and appeared before me on August 25, 2014 to execute the above Confirmatory Assignment.

3. Edwin S. Olson subscribed to the above Confirmatory Assignment.

I declare under penalty of perjury under the laws of the United States of America that the statements made in the three (3) numbered paragraphs immediately above are true and correct.

EXECUTED on August 25, 2014 (date)

_____
Print Name: James R Duncan

Exhibit A

1. U.S. Patent No. 7,435,286, issued October 14, 2008, titled "Sorbents for the Oxidation and Removal of Mercury"

2. U.S. Patent No. 7,615,101, issued November 10, 2009, titled "High Energy Dissociation for Mercury Control Systems"

3. U.S. Patent No. 7,628,969, issued December 8, 2009, titled "Multifunctional Abatement of Air Pollutants in Flue Gas"

4. U.S. Patent No. 8,168,147, issued May 1, 2012, titled "Sorbents for the Oxidation and Removal of Mercury"

5. U.S. Patent No. 8,173,566, issued May 8, 2012, titled "Process for Regenerating a Spent Sorbent"

6. U.S. Patent No. 8,312,822, issued November 20, 2012, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

7. U.S. Patent No. 8,440,585, issued May 14, 2013, titled "Process for Regenerating a Spent Sorbent"

8. U.S. Patent No. 8,512,655, issued August 20, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

9. U.S. Patent No. 8,652,235, issued February 18, 2014, titled "Sorbents for the Oxidation and Removal of Mercury"

10. U.S. Patent No. 8,807,056, issued August 19, 2014, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

11. U.S. Patent Application Serial No. 13/453,274, filed on April 23, 2012, titled "Carbon Nanocomposite Sorbent and Methods of Using the Same for Separation of One or More Materials from a Gas Stream"

12. U.S. Patent Application Serial No. 13/544,971, filed on July 9, 2012, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

13. U.S. Patent Application Serial No. 13/966,768, filed on August 14, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

14. U.S. Patent Application Serial No. 14/102,896, filed on December 11, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

15. U.S. Patent Application Serial No. 14/318,270, filed on June 27, 2014, titled "Sorbents for the Oxidation and Removal of Mercury"

16. U.S. Patent Application Serial No. 14/195,360, filed on March 6, 2013, titled "Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same"

17. U.S. Patent Application Serial No. 14/446,992, filed on July 30, 2014, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

18. U.S. Provisional Patent Application Serial No. 60/605,640, filed on August 30, 2004, titled "Sorbents for the Oxidation and Removal of Mercury"

19. U.S. Provisional Patent Application Serial No. 60/464,868, filed on April 23, 2003, titled "Process for Regenerating a Spent Sorbent"

20. U.S. Provisional Patent Application Serial No. 60/947,543, filed on July 2,2007, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

21. U.S. Provisional Patent Application Serial No. 61/773,549, filed on March 6, 2013, titled "Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same"

CONFIRMATORY ASSIGNMENT

THIS CONFIRMATORY ASSIGNMENT is made by John H. Pavlish residing at 4220 4 210 th St SW, East Grand Forks, MN ("Assignor"), to Energy and Environmental Research Center Foundation, a North Dakota nonprofit corporation having a business address of 15 N. 23rd Street, Stop 9018, Grand Forks, North Dakota, 58202-9018 ("Assignee") and is effective as of the date this Confirmatory Assignment is executed by Assignor.

WHEREAS, Assignor has invented the inventions disclosed in the patents and patent applications listed in Exhibit A attached (collectively, and including all such inventions and all patents and patent applications for such inventions that have now been, or may in the future be, filed and/or granted for such inventions, including without limitation those patents and patent applications listed in Exhibit A, "Inventions") and, for good and valuable consideration, has agreed to assign, and has assigned, all of Assignor's right, title and interest in and to the Inventions to Assignee; and

WHEREAS, Assignor desires to confirm and assure the assignment, sale and transfer to Assignee of any and all right, title, and interest Assignor has in the Inventions; and

WHEREAS, this Confirmatory Assignment confirms that all Inventions listed in Exhibit A belong exclusively to Assignee and that Assignor has assigned, sold and transferred to Assignee, and hereby further assigns, sells and transfers to Assignee, without any requirement of further consideration, the entire right, title and interest in and to the Inventions, in the United States and its territorial possessions, and in all foreign countries, including without limitation all rights to claim priority in and to any and all improvements which are disclosed in the Inventions, and that upon the request of the Assignee, Assignor will take such further actions, including without limitation execution and delivery of instruments of conveyance, as may be appropriate to give full and proper effect to such assignment.

NOW THEREFORE, in consideration of the foregoing premises, the sum of Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor hereby assigns, sells and transfers to Assignee Assignor's entire right, title and interest in and to the Inventions, in the United States and its territorial possessions, and in all foreign countries, including without limitation: (1) all rights to claim priority in and to the Inventions and/or any and all improvements which are disclosed in the Inventions; (2) all rights with respect to the Inventions, including all United States patents and/or other

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governmental grants and/or issuances that may be granted with respect to the Inventions and/or from any direct and/or indirect divisionals, continuations, continuations-in-part and/or other patent applications claiming priority rights from the Inventions; (3) all reissues, reexaminations, extensions and/or registrations of the foregoing; (4) all non-United States patents, patent applications and/or counterparts relating to the foregoing, including without limitation certificates of invention, utility models, industrial design protection, design patent protection and other governmental grants and/or issuances, and including the right to file United States and/or foreign applications directly in the name of Assignee, its successors and assigns; (5) all causes of action and/or remedies related to the foregoing (including without limitation, the right to sue for past, present and/or future infringement, misappropriation and/or violation of rights related to any of the foregoing and the right to collect royalties and/or other payments under or on account of any of the foregoing); and, (6) any and all other rights and/or interests arising out of, in connection with and/or in relation to the foregoing.

Assignor hereby covenants that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this Confirmatory Assignment.

Assignor agrees now, and at any time and from time to time in the future, upon request of Assignee, Assignee's successors, legal representatives and/or assigns, and at Assignee's expense, to take, execute, acknowledge, and deliver all such further acts and deeds, assignments, instruments of transfer or conveyance, registrations for assignments, powers of attorney, declarations and/or assurances as may be required for the assigning, selling, transferring, assuring and confirming to Assignee, and Assignee's successors and assigns, and/or for aiding and assisting in collecting and reducing to possession, the rights assigned, sold and transferred under this Confirmatory Assignment, to participate in proceedings regarding such rights (including without limitation, any litigation and/or patent office proceedings) and/or to or perfect and/or defend title to such rights.

Assignor requests the respective patent office or governmental agency in each jurisdiction to issue any and all patents, certificates of invention, utility models and/or other governmental grants and/or issuances that may be granted upon the rights assigned, sold and transferred under this Confirmatory Assignment in the name of the Assignee, as the assignee to the entire interest therein.

The terms and conditions of this Confirmatory Assignment will inure to the benefit of Assignee, and Assignee's successors, legal representatives and assigns, and will be binding upon Assignor, and Assignor's successors, legal representatives and assigns.

By: _____
(John H. Pavlish, *Signature MUST be attested*)

ATTESTATION

ATTESTATION OF SIGNATURE PURSUANT TO 28 U.S.C. 1746

The undersigned witnessed the signature of John H. Pavlish to the above Confirmatory Assignment and makes the following statements:

1. I am over the age of 18 and competent to testify as to the facts in this Attestation block if called upon to do so.

2. John H. Pavlish is personally known to me (or proved to me on the basis of satisfactory evidence) and appeared before me on August 25, 2014 to execute the above Confirmatory Assignment.

3. John H. Pavlish subscribed to the above Confirmatory Assignment.

I declare under penalty of perjury under the laws of the United States of America that the statements made in the three (3) numbered paragraphs immediately above are true and correct.

EXECUTED on August 25, 2014 (date)

_____
Print Name: James R Duzan

Exhibit A

1. U.S. Patent No. 7,435,286, issued October 14, 2008, titled "Sorbents for the Oxidation and Removal of Mercury"

2. U.S. Patent No. 7,615,101, issued November 10, 2009, titled "High Energy Dissociation for Mercury Control Systems"

3. U.S. Patent No. 7,628,969, issued December 8, 2009, titled "Multifunctional Abatement of Air Pollutants in Flue Gas"

4. U.S. Patent No. 8,168,147, issued May 1, 2012, titled "Sorbents for the Oxidation and Removal of Mercury"

5. U.S. Patent No. 8,173,566, issued May 8, 2012, titled "Process for Regenerating a Spent Sorbent"

6. U.S. Patent No. 8,312,822, issued November 20, 2012, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

7. U.S. Patent No. 8,440,585, issued May 14, 2013, titled "Process for Regenerating a Spent Sorbent"

8. U.S. Patent No. 8,512,655, issued August 20, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

9. U.S. Patent No. 8,652,235, issued February 18, 2014, titled "Sorbents for the Oxidation and Removal of Mercury"

10. U.S. Patent No. 8,807,056, issued August 19, 2014, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

11. U.S. Patent Application Serial No. 13/453,274, filed on April 23, 2012, titled "Carbon Nanocomposite Sorbent and Methods of Using the Same for Separation of One or More Materials from a Gas Stream"

12. U.S. Patent Application Serial No. 13/544,971, filed on July 9, 2012, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

13. U.S. Patent Application Serial No. 13/966,768, filed on August 14, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

14. U.S. Patent Application Serial No. 14/102,896, filed on December 11, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

15. U.S. Patent Application Serial No. 14/318,270, filed on June 27, 2014, titled "Sorbents for the Oxidation and Removal of Mercury"

16. U.S. Patent Application Serial No. 14/195,360, filed on March 6, 2013, titled "Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same"

17. U.S. Patent Application Serial No. 14/446,992, filed on July 30, 2014, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

18. U.S. Provisional Patent Application Serial No. 60/605,640, filed on August 30, 2004, titled "Sorbents for the Oxidation and Removal of Mercury"

19. U.S. Provisional Patent Application Serial No. 60/464,868, filed on April 23, 2003, titled "Process for Regenerating a Spent Sorbent"

20. U.S. Provisional Patent Application Serial No. 60/947,543, filed on July 2,2007, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

21. U.S. Provisional Patent Application Serial No. 61/773,549, filed on March 6, 2013, titled "Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same"

CONFIRMATORY ASSIGNMENT

THIS CONFIRMATORY ASSIGNMENT is made by Michael J. Holmes residing at 2124 S 38th St, Grand Forks, ND ("Assignor"), to Energy and Environmental Research Center Foundation, a North Dakota nonprofit corporation having a business address of 15 N. 23rd Street, Stop 9018, Grand Forks, North Dakota, 58202-9018 ("Assignee") and is effective as of the date this Confirmatory Assignment is executed by Assignor.

WHEREAS, Assignor has invented the inventions disclosed in the patents and patent applications listed in Exhibit A attached (collectively, and including all such inventions and all patents and patent applications for such inventions that have now been, or may in the future be, filed and/or granted for such inventions, including without limitation those patents and patent applications listed in Exhibit A, "Inventions") and, for good and valuable consideration, has agreed to assign, and has assigned, all of Assignor's right, title and interest in and to the Inventions to Assignee; and

WHEREAS, Assignor desires to confirm and assure the assignment, sale and transfer to Assignee of any and all right, title, and interest Assignor has in the Inventions; and

WHEREAS, this Confirmatory Assignment confirms that all Inventions listed in Exhibit A belong exclusively to Assignee and that Assignor has assigned, sold and transferred to Assignee, and hereby further assigns, sells and transfers to Assignee, without any requirement of further consideration, the entire right, title and interest in and to the Inventions, in the United States and its territorial possessions, and in all foreign countries, including without limitation all rights to claim priority in and to any and all improvements which are disclosed in the Inventions, and that upon the request of the Assignee, Assignor will take such further actions, including without limitation execution and delivery of instruments of conveyance, as may be appropriate to give full and proper effect to such assignment.

NOW THEREFORE, in consideration of the foregoing premises, the sum of Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor hereby assigns, sells and transfers to Assignee Assignor's entire right, title and interest in and to the Inventions, in the United States and its territorial possessions, and in all foreign countries, including without limitation: (1) all rights to claim priority in and to the Inventions and/or any and all improvements which are disclosed in the Inventions; (2) all rights with respect to the Inventions, including all United States patents and/or other

governmental grants and/or issuances that may be granted with respect to the Inventions and/or from any direct and/or indirect divisionals, continuations, continuations-in-part and/or other patent applications claiming priority rights from the Inventions; (3) all reissues, reexaminations, extensions and/or registrations of the foregoing; (4) all non-United States patents, patent applications and/or counterparts relating to the foregoing, including without limitation certificates of invention, utility models, industrial design protection, design patent protection and other governmental grants and/or issuances, and including the right to file United States and/or foreign applications directly in the name of Assignee, its successors and assigns; (5) all causes of action and/or remedies related to the foregoing (including without limitation, the right to sue for past, present and/or future infringement, misappropriation and/or violation of rights related to any of the foregoing and the right to collect royalties and/or other payments under or on account of any of the foregoing); and, (6) any and all other rights and/or interests arising out of, in connection with and/or in relation to the foregoing.

Assignor hereby covenants that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this Confirmatory Assignment.

Assignor agrees now, and at any time and from time to time in the future, upon request of Assignee, Assignee's successors, legal representatives and/or assigns, and at Assignee's expense, to take, execute, acknowledge, and deliver all such further acts and deeds, assignments, instruments of transfer or conveyance, registrations for assignments, powers of attorney, declarations and/or assurances as may be required for the assigning, selling, transferring, assuring and confirming to Assignee, and Assignee's successors and assigns, and/or for aiding and assisting in collecting and reducing to possession, the rights assigned, sold and transferred under this Confirmatory Assignment, to participate in proceedings regarding such rights (including without limitation, any litigation and/or patent office proceedings) and/or to or perfect and/or defend title to such rights.

Assignor requests the respective patent office or governmental agency in each jurisdiction to issue any and all patents, certificates of invention, utility models and/or other governmental grants and/or issuances that may be granted upon the rights assigned, sold and transferred under this Confirmatory Assignment in the name of the Assignee, as the assignee to the entire interest therein.

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The terms and conditions of this Confirmatory Assignment will inure to the benefit of Assignee, and Assignee's successors, legal representatives and assigns, and will be binding upon Assignor, and Assignor's successors, legal representatives and assigns.

By: _____
(Michael J. Holmes, *Signature MUST be attested*)

ATTESTATION

ATTESTATION OF SIGNATURE PURSUANT TO 28 U.S.C. 1746

The undersigned witnessed the signature of Michael J. Holmes to the above Confirmatory Assignment and makes the following statements:

1. I am over the age of 18 and competent to testify as to the facts in this Attestation block if called upon to do so.

2. Michael J. Holmes is personally known to me (or proved to me on the basis of satisfactory evidence) and appeared before me on August 22, 2014 to execute the above Confirmatory Assignment.

3. Michael J. Holmes subscribed to the above Confirmatory Assignment.

I declare under penalty of perjury under the laws of the United States of America that the statements made in the three (3) numbered paragraphs immediately above are true and correct.

EXECUTED on August 22, 2014 (date)

James R Duzan

Print Name: James R Duzan

Exhibit A

1. U.S. Patent No. 7,435,286, issued October 14, 2008, titled "Sorbents for the Oxidation and Removal of Mercury"

2. U.S. Patent No. 7,615,101, issued November 10, 2009, titled "High Energy Dissociation for Mercury Control Systems"

3. U.S. Patent No. 7,628,969, issued December 8, 2009, titled "Multifunctional Abatement of Air Pollutants in Flue Gas"

4. U.S. Patent No. 8,168,147, issued May 1, 2012, titled "Sorbents for the Oxidation and Removal of Mercury"

5. U.S. Patent No. 8,173,566, issued May 8, 2012, titled "Process for Regenerating a Spent Sorbent"

6. U.S. Patent No. 8,312,822, issued November 20, 2012, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

7. U.S. Patent No. 8,440,585, issued May 14, 2013, titled "Process for Regenerating a Spent Sorbent"

8. U.S. Patent No. 8,512,655, issued August 20, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

9. U.S. Patent No. 8,652,235, issued February 18, 2014, titled "Sorbents for the Oxidation and Removal of Mercury"

10. U.S. Patent No. 8,807,056, issued August 19, 2014, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

11. U.S. Patent Application Serial No. 13/544,971, filed on July 9, 2012, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

12. U.S. Patent Application Serial No. 13/966,768, filed on August 14, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

13. U.S. Patent Application Serial No. 14/102,896, filed on December 11, 2013, titled "Sorbents for the Oxidation and Removal of Mercury"

14. U.S. Patent Application Serial No. 14/318,270, filed on June 27, 2014, titled "Sorbents for the Oxidation and Removal of Mercury"

15. U.S. Patent Application Serial No. 14/446,992, filed on July 30, 2014, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

16. U.S. Provisional Patent Application Serial No. 60/605,640, filed on August 30, 2004, titled "Sorbents for the Oxidation and Removal of Mercury"

17. U.S. Provisional Patent Application Serial No. 60/464,868, filed on April 23, 2003, titled "Process for Regenerating a Spent Sorbent"

18. U.S. Provisional Patent Application Serial No. 60/947,543, filed on July 2,2007, titled "Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds"

ASSIGNMENT

THIS ASSIGNMENT is made and effective as of April 24, 2017 by and between the ENERGY AND ENVIRONMENTAL RESEARCH CENTER FOUNDATION ("**EERC Foundation**"), a non-profit corporation organized under the laws of the State of North Dakota, having its principal place of business at 15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202, and MIDWEST ENERGY EMISSIONS CORP., a Delaware corporation ("**ME_2C**"), having its principal place of business at 670 D Enterprise Drive, Lewis Center, Ohio 43035.

WHEREAS, EERC Foundation owns by ASSIGNMENT from the named inventors recorded in the United States Patent and Trademark Office, the right, title, and interest in the patents and patent applications listed in **Appendix A** attached hereto; and

WHEREAS, ME_2C desires to own EERC Foundation's entire right, title, and interest in and to the patents and patent applications listed in **Appendix A**.

NOW THEREFORE, be it known that, for good and valuable consideration, receipt of which is hereby acknowledged, the EERC Foundation hereby sells, assigns, transfers and sets over to ME_2C, its lawful successors and assigns, all rights, titles, interests, and accrued causes of action for damages for infringement of, all patents, patent applications, all divisions, substitutions, continuations, continuations-in-part, reissues, reexaminations, and extensions thereof, together with all foreign counterparts thereof and patents issuing thereon derived from or claiming priority of the United States provisional patent application or other provisional patent application filed for an issued patent or patent application as set forth in **Appendix A**;

AND, EERC Foundation hereby represents, warrants and agrees that EERC Foundation has the full right to convey the interests assigned by this ASSIGNMENT, and has obtained the approval from the U.S. Department of Energy and from the U.S. Environmental Protection Agency necessary to transfer the interests assigned hereby to ME_2C;

AND, this ASSIGNMENT may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, each party has caused its authorized representative to execute this ASSIGNMENT, effective as of the date indicated above.

Energy and Environmental Research Center Foundation

By: _____
Name: Ron Ness
Title: President

Midwest Energy Emissions Corp.

By: _____
Name: Richard H. Gross
Title: Chief Financial Officer

ACKNOWLEDGMENT

State of North Dakota)
) ss:
County of Burleigh)

KAY A. ROTH
Notary Public
State of North Dakota
My Commission Expires September 4, 2021

On the 27th day of April, 2017, before me, the undersigned, personally appeared Ron Ness, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed this instrument on behalf of Energy and Environmental Research Center Foundation, and acknowledged that he executed it in such representative capacity.

Kay A. Roth
Notary Public

ACKNOWLEDGMENT

State of Ohio)
) ss:
County of Delaware)

On the 19 day of May April, 2017, before me, the undersigned, personally appeared Richard H. Gross, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed this instrument on behalf of Midwest Energy Emissions Corp., and acknowledged that he executed it in such representative capacity.

Geraldine A Craig
Notary Public

GERALDINE A. CRAIG - NOTARY PUBLIC - STATE OF OHIO

APPENDIX A
PATENTS AND PATENT APPLICATIONS

Issued Patents

U.S. Patents

- U.S. Patent 7,435,286 – Sorbents for the Oxidation and Removal of Mercury (05-001)
- U.S. Patent 8,173,566 – Process for Regenerating a Spent Sorbent (PAC Regen) (03-023)
- U.S. Patent 8,168,147 – Sorbents for the Oxidation and Removal of Mercury (09-012)
- U.S. Patent 8,312,822 – Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds (06-001)
- U.S. Patent 8,440,585 – Process for Regenerating a Spent Sorbent (03-023US1 CONT)
- U.S. Patent 7,615,101 – High Energy Dissociation for Mercury Control Systems (05-015)
- U.S. Patent 7,628,969 – Multifunctional Abatement of Air Pollutants in Flue Gas (09006CIP of 05-015)
- U.S. Patent 8,807,056 – Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds (06-001CONT)
- U.S. Patent 8,512,655 – Sorbents for the Oxidation and Removal of Mercury (09-012CONT1)
- U.S. Patent 8,652,235 – Sorbents for the Oxidation and Removal of Mercury (09-013CIP)
- U.S. Patent 8,821,819 – Sorbents for the Oxidation and Removal of Mercury (09-012CONT2)
- U.S. Patent 9,011,805 – Carbon Nanocomposite Sorbent and Methods of Using the Same for Separation of One or More Materials from a Gas Stream (12-001)
- U.S. Patent 9,155,997 – Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds (06-001CONT2)
- U.S. Patent 9,468,886- Sorbents for the Oxidation and Removal of Mercury (09-013CIP CONT1)

Foreign Patents

- Canada Patent 2,523,132 – Process for Regenerating a Spent Sorbent (03-023)
- Canada Patent 2,584,327 – Sorbents for the Oxidation and Removal of Mercury (05-001)
  Canadian Patent 2,757,309 Sorbents for the Oxidation and Removal of Mercury (09-013)

- China Patent ZL200580037037.0 (Certificate No. 635764) – Sorbents and Flue Gas Additives for the Oxidation and Removal of Mercury (05-001)

- Europe Patent 1 796 816 – Sorbents for the Oxidation and Removal of Mercury (05-001EP)
- Europe Divisional No. 2 431 087 – Removal of Mercury from Flue Gas (05-001EU Div1)
  - Validating the patent application in Germany for issuance of patent
  - Validating the patent application in the Netherlands for issuance of patent
  - Validating the patent application in the United Kingdom for issuance of patent
- Europe Patent 2 429 685 – Sorbents for the Oxidation and Removal of Mercury (09013EP)
  - Validating the patent application in Germany for issuance of patent
  - Validating the patent application in the Netherlands for issuance of patent
  - Validating the patent application in the United Kingdom for issuance of patent 200480017704.4
- China Patent ZL200680041485.2 – High-Energy Dissociation for Mercury Control Systems (05-015CN)
- Europe Patent 1 931 449 – High-Energy Dissociation for Mercury Control Systems (05015EP)
  - Validating the patent application in Germany for issuance of patent
  - Validating the patent application in the Netherlands for issuance of patent
  - Validating the patent application in the United Kingdom for issuance of patent
- China Patent ZL201080017698.8 Process for Regenerating a Spent Sorbent (PAC Regen) (09-013CN)
- China Patent ZL200480017704.4 Process for Regenerating a Spent Sorbent (PAC Regen) (03-023CN)

Pending Patent Applications

U.S. Patents

- Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same – Application Serial No. 14/195,360 (13-004)
- Sorbents for the Oxidation and Removal of Mercury – Application Serial No. 14/318,270 (09-012CONT3)
- Sorbents for the Oxidation and Removal of Mercury – Application Serial No. 15/295,594 (09-013CONT2)
- Carbon Nanocomposite Sorbent and Methods of Using the Same for Separation of One or More Materials from a Gas Stream – Application Serial No. 14/564,860 (12-001Cont)
- Sorbents for the Oxidation and Removal of Mercury – Application Serial No. 14/712,558 (09-012CONT4)
- Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds – Application Serial No. 14/880,463 (06-001CONT3)
- Promoted Ammonium Salt-Protected Activated Carbon Sorbent Particles For Removal of Mercury From Gas Streams-Application Serial No. 15/382,114 (13-004 CIP)

- Sorbent Comprising Carbon and Nitrogen and Methods of Using the Same—Application Serial No. 15/449,112 (13-004 CIP2)
- Carbon Nanocomposite Sorbent and Methods of Using the Same for Separation of One or More Materials from a Gas Stream – Application Serial No. 15/452,527 (12-001Cont2)

Foreign Patents

- Process for Regenerating a Spent Sorbent (PAC Regen) (03-023)
  - Application pending in European Patent Office – Application Serial No. 04750664.7
- Sorbents and Flue Gas Additives for the Oxidation and Removal of Mercury (05-001)
- Note: A different divisional – Application Serial No. 11 189 249.3 – was abandoned as unpatentable over prior art
- Carbon Nanocomposite Sorbent and Methods of Using the Same for Separation of One or More Materials from a Gas Stream (12-001PCT)
  - Application pending in Europe
  - Application pending in China
  - Application pending in Canada
- Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same (13-004PCT)
  - Application pending in Canada
  - Application pending in China
  - Application pending in Europe

Provisional Patent Applications

U.S. Patents

- Sorbents for the Oxidation and Removal of Mercury – U.S. Provisional Patent Application Serial No. 60/605,640 (05-001PRV)
- Process for Regenerating a Spent Sorbent – U.S. Provisional Patent Application Serial No. 60/464,868 (03-023PRV)
- Mercury Control Using Moderate-Temperature Dissociation of Halogen Compounds – U.S. Provisional Patent Application Serial No. 60/947,543 (06-001PRV)
- Activated Carbon Sorbent Including Nitrogen and Methods of Using the Same – Application Serial Number 61/773,549 (13-004PRV)

Appendix A

Application #	SLW File #	Patent #
11/209,163	4820.001US1	7,435,286
10/554,018	4820.002US1	8,173,566
12/419,219	4820.001US3	8,168,147
12/167,054	4820.008US1	8,312,822
13/425,288	4820.002US2	8,440,585
11/220,810	4820.009US1	7,615,101
12/177,771	4820.010US1	7,628,969
13/544,971	4820.008US2	8,807,056
13/427,665	4820.001US4	8,512,655
12/429,058	4820.007US1	8,652,235
13/966,768	4820.001US5	8,821,819
13/453,274	4820.006US1	9,011,805
14/446,992	4820.008US3	9,155,997
14/102,896	4820.007US2	9,468,886
14/195,360	4820.003US1	9,669,355
14/318,270	4820.001US6	
15/295,594	4820.007US3	
14/564,860	4820.006US2	9,662,629
14/712,558	4820.001US7	
14/880,463	4820.008US4	9,675,931
15/382,114	4820.004US1	
15/449,112	4820.005US1	
15/452,527	4820.006US3	
60/605,640	4820.001PRV	
60/464,868	4820.002PRV	
60/947,543	4820.008PRV	
61/773,549	4820.003PRV	

Amended PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Midwest Energy Emissions Corp.

Application No./Patent No.: 15/974,343 Filed/Issue Date: May 8, 2018

Titled: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Midwest Energy Emissions Corp. a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3 ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 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, 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.**

Amended PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Nicholas P. Lanzatella/

Signature

09/27/2019

Date

Nicholas P. Lanzatella

Printed or Typed Name

USPTO Reg. No. 63,803

Title or Registration Number

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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:

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix

Residence Information (Select One) ☐ US Residency ☐ Non US Residency ☐ Active US Military Service

City		State/Province		Country of Residence	

Mailing Address of Inventor:

Address 1	
Address 2	

City		State/Province	
Postal Code		Country	

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	
Email Address	

Application Information:

Title of the Invention			
Attorney Docket Number		Small Entity Status Claimed ☐	
Application Type			
Subject Matter			
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country Publication

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). Enter either 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	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number			

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(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
This Application	continuation of	15/951,970	2018-04-12
Prior Application Status	Pending		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
15/951,970	continuation of	14/712,558	2015-05-14
Prior Application Status	Pending		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14/712,558	continuation of	14/318,270	~~2014-06-14~~ 2014-06-27
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
14/318,270	continuation of	13/966,768	2013-08-14
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
13/966,768	continuation of	13/427,665	2012-03-22
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
13/427,665	continuation of	12/419,219	2009-04-06
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
12/419,219	continuation of	12/201,595	2008-08-29
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
12/201,595	continuation of	11/209,163	2005-08-22
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
11/209,163	Claims benefit of provisional	60/605,640	2004-08-30

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. 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(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)i the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the POX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant must opt-out of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is ONLY reviewed and processed with the INITIAL filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby grants the USPTO authority to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ **A. Applicant DOES NOT authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.**

☐ **B. Applicant DOES NOT authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.**

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

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: ~~Midwest Energy Emissions Corp~~ Midwest Energy Emissions Corp.

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.

☒ 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:

☐ Deceased	☐ Legally incapacitated

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here: ☒

Organization Name: ~~Midwest Energy Emissions Corp~~ Midwest Energy Emissions Corp.

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1	670 D Enterprise Drive		
Address 2			
City	Lewis Center	State/Province	OH
Country	United States of America	Postal Code	43035
Phone Number			
Email Address			

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. 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	4820.001US9
	Application Number	15/974,343
Title of Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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.

Assignee Information including Non-Applicant Assignee 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.

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is **a juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Nicholas P. Lanzatella/			Date (YYYY-MM-DD)	2019-09-27
First Name	Nicholas	Last Name	Lanzatella	Registration Number	63,803

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 22313-14**

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

21186 7590 09/17/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER
ORLANDO, AMBER ROSE

ART UNIT	PAPER NUMBER
1776	

DATE MAILED: 09/17/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

TITLE OF INVENTION: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	12/17/2019

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

21186 7590 09/17/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

TITLE OF INVENTION: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	12/17/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
ORLANDO, AMBER ROSE	1776	423-210000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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.
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.
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.

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.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 09/17/2019

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	
ART UNIT	**PAPER NUMBER**
1776	

DATE MAILED: 09/17/2019

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 30 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.
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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.

Notice of Allowability	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA (FITF) 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 the correspondence filed 08/28/2019.
   ☐ 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 27-55 . 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 _____.

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

Terminal Disclaimer

The terminal disclaimer filed on 08/28/2019 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of 7,435,286; 8,168147; 8,512,655; 8,821,819; 9,757,689; 9,468,886; 8,652,235; 15/295,594; 15/589,359; 15/853,029; 14/712,558; 15/651,970; 15/358,114; 15/978,760 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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.

AMBER ROSE. ORLANDO
Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO
Inventor Search (EAST)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	01/07/2019	AO
IDS Search (DAV and EAST)	08/17/2019	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	SEE EAST SEARCH HISTORY	09/09/2019	AO

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	**Art Unit**
	AMBER R ORLANDO	1776

CPC						
Symbol					**Type**	**Version**
B01D	/	53	/	64	F	2013-01-01
B01D	/	53	/	10	I	2013-01-01
B01J	/	20	/	20	I	2013-01-01
B01J	/	20	/	22	I	2013-01-01
B01D	/	2253	/	102	A	2013-01-01
B01D	/	2257	/	602	A	2013-01-01
Y10S	/	95	/	901	A	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	09 September 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	27	11

U.S. Patent and Trademark Office — Part of Paper No.: 20190909

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	**Art Unit**
	AMBER R ORLANDO	1776

INTERNATIONAL CLASSIFICATION				
CLAIMED				
B01D	/	53	/	64
B01D	/	53	/	10
B01J	/	20	/	20
B01J	/	20	/	22

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE (Assistant Examiner) (Date)		**Total Claims Allowed:** 29	
/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776 (Primary Examiner)	09 September 2019 (Date)	O.G. Print Claim(s) 27	O.G. Print Figure 11

U.S. Patent and Trademark Office

Part of Paper No.: 20190909

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	**Art Unit**
	AMBER R ORLANDO	1776

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

CLAIMS

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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	09 September 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	27	11

U.S. Patent and Trademark Office — Part of Paper No.: 20190909

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Response filed 07-10-19 to Final Office Action mailed - 1-11-19", 57 pgs.	
	"Application Serial No. 15/295,594, Final Office Action mailed 08-02-19", 18 pgs	
	"Application Serial No. 15/589,359, Notice of Allowance mailed 07-31-19", 7 pgs	
	"Application Serial No. 15/589,359, Response filed 07-16-19 to Non Final Office Action mailed 06-21-19", 7 pgs.	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 08-23-19", 14 pgs	
	"Application Serial No. 15/997,091, Response filed 07-10-19 to Final Office Action mailed 01-11-19", 80 pgs.	

/AMBER R ORLANDO/

EXAMINER DATE CONSIDERED 09/09/2019

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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	5556447		1996-09-17	Srinivasachar, Srivats, et al.	
	2	7361209		2008-04-22	Durham, Michael D, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020114749	A1	2002-08-22	Cole, Jerald Alan	
	2	20030113239	A1	2003-06-19	Pahlman, John E, et al.	
	3	20030161771	A1	2003-08-28	Oehr, Klaus H	
	4	20040244657	A1	2004-12-09	Srinivasachar, Srivats, et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15974343
	Filing Date	2018-05-08
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9

	5	20070259781	A1	2007-11-08	Sinha, Rabindra K	
	6	20140099244	A1	2014-04-10	Olson, Edwin S, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

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]
	1	"Application Serial No. 16/509,071, Non Final Office Action mailed 09-11-19", 21 pgs.	
	2	"Application Serial No. 14/712,558, Non Final Office Action mailed 09-12-19", 15 pgs.	

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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

[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	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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	/Nicholas P. Lanzatella.	Date (YYYY-MM-DD)	2019-09-13
Name/Print	Nicholas P. Lanzatella	Registration Number	63,803

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

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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.

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	David L. Buck/Jamie Johnson
Attorney Docket Number:	4820.001US9

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	37164535
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	David L. Buck/Jamie Johnson
Filer Authorized By:	David L. Buck
Attorney Docket Number:	4820.001US9
Receipt Date:	13-SEP-2019
Filing Date:	08-MAY-2018
Time Stamp:	17:37:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	E20199CH37350076
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	15974343_ids_09-13-2019.pdf	626706 138f9b4b892b9f9527e796da45a3f756186d3d0c	no	5
Warnings:					
Information:					
2	Non Patent Literature	0001_2_npl_4820001u11_oarnpe_20190911_f.pdf	919625 6f248de285471acc89924d9d49dc623346f33ba8	no	21
Warnings:					
Information:					
3	Non Patent Literature	0002_2_npl_4820001us7_oarn_09122019_f.pdf	707212 2a90ed576493338d3ef4a9fd7963c45742de03af	no	15
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30746 6b5d945dddb4c2cab3d21dc6153523710bb11f30	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2284289		

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.

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
* 15/974,343 *	15/974,343	Olson et al.	
	Examiner	**Art Unit**	
	ORLANDO, AMBER ROSE	1776	

Document Code - DISQ	**Internal Document - DO NOT MAIL**

TERMINAL DISCLAIMER	☑ APPROVED	☐ DISAPPROVED
Date Filed: 28 August 2019	**This patent is subject to a Terminal Disclaimer**	

Approved/Disapproved by:

/JEAN PROCTOR/

Technology Center: OPLC

Telephone: (571)272-1040

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9

CONFIRMATION NO. 1072

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

POA ACCEPTANCE LETTER

OC000000110783603

Date Mailed: 08/30/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/28/2019.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/mnguyen/

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
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/974,343	Filing Date 05/08/2018	☐ To be Mailed

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), (l), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	08/28/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 29	Minus	** 29	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/BRENDA V HARRISON/
*** 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.	

This collection of information is required by 37 CFR 1.16. 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, 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	37005422
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Edward James Sandor/Beth Moon
Filer Authorized By:	Edward James Sandor
Attorney Docket Number:	4820.001US9
Receipt Date:	28-AUG-2019
Filing Date:	08-MAY-2018
Time Stamp:	14:53:01
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	Non Patent Literature	npl1_4820001U10_OARN_08232019.pdf	1415213 82e99d7aeee8913bcc69c1112a10bad6c697395c	no	14

Warnings:

Information:					
2	Non Patent Literature	npl2_4820007US3_FOAR_08022019.pdf	1878950 641caeec846be5b8f4f82836921e3fd4838bba89	no	18
Warnings:					
Information:					
3	Non Patent Literature	npl3_4820003US2_NOAR_07312019.pdf	1126931 f2c93637028800514d0b15699722fab44e8a92f6	no	7
Warnings:					
Information:					
4	Non Patent Literature	npl4_4820003US2_AARN_07-16-19.pdf	118986 9788f7869e88c1fce840d36db4710cf0077e1625	no	7
Warnings:					
Information:					
5	Non Patent Literature	npl5_4820001US7_AARF_07-10-19.pdf	4606138 a496173b7f14b930c3339aa234eeabc004875c7a	no	57
Warnings:					
Information:					
6	Non Patent Literature	npl6_4820001U10_AARF_07-10-19.pdf	5515022 1f63566324a580614d6b32dbd34307c00e5419e4	no	80
Warnings:					
Information:					
		Total Files Size (in bytes):	14661240		

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.

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS			
Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document

FOREIGN PATENT DOCUMENTS				
Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS		
Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Response filed 07-10-19 to Final Office Action mailed - 1-11-19", 57 pgs.	
	"Application Serial No. 15/295,594, Final Office Action mailed 08-02-19", 18 pgs	
	"Application Serial No. 15/589,359, Notice of Allowance mailed 07-31-19", 7 pgs	
	"Application Serial No. 15/589,359, Response filed 07-16-19 to Non Final Office Action mailed 06-21-19", 7 pgs.	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 08-23-19", 14 pgs	
	"Application Serial No. 15/997,091, Response filed 07-10-19 to Final Office Action mailed 01-11-19", 80 pgs.	

EXAMINER DATE CONSIDERED

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Modified PTO/AIA/26 (04-14)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT

Docket Number 4820.001US9

In re Application of: Edwin S. Olson et al.

Application No.: 15/974,343

Filed: May 8, 2018

For: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

The applicant, **Midwest Energy Emissions Corp**, owner of the entire interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent No.(s)/prior Application No.(s)** **7,435,286; 8,168,147, 8,512,655, 8,821,819, 9,757,689, 9,468,886, 8,652,235, 15/295,594, 15/589,359, 15/853,029, 14/712,558, 15/951,970, 15/382,114, 15/978,760,** as the term of said **prior patent(s)/prior Application No.(s)** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent(s)** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent(s)**, "as the term of said **prior patent(s)** is presently shortened by any terminal disclaimer," in the event that said **prior patent(s)** later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

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

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 63,803

/Nicholas P. Lanzatella/ August 28, 2019

Nicholas P. Lanzatella **Date**

Attorney 612-359-9580

Title **Telephone Number**

☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Amended PTO/AIA/82B(07-13)
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: **21186**

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☒ The address associated with the above mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Midwest Energy Emissions Corp.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	John Pavlish	Date (Optional)	6/9/2017
Name	John Pavlish		
Title	Chief Technology Officer		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☒ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Amended PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Midwest Energy Emissions Corp

Application No./Patent No.: 15/974,343 Filed/Issue Date: May 8, 2018

Titled: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Midwest Energy Emissions Corp a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3 ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 042647, Frame 0351-0359, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 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, 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.**

Amended PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Nicholas P. Lanzatella/
Signature

August 28, 2019
Date

Nicholas P. Lanzatella
Printed or Typed Name

USPTO Reg. No. 63,803
Title or Registration Number

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Edward James Sandor/Beth Moon
Attorney Docket Number:	4820.001US9

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
		Total in USD ($)		**400**

Electronic Acknowledgement Receipt

EFS ID:	37005358
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Edward James Sandor/Beth Moon
Filer Authorized By:	Edward James Sandor
Attorney Docket Number:	4820.001US9
Receipt Date:	28-AUG-2019
Filing Date:	08-MAY-2018
Time Stamp:	14:50:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$400
RAM confirmation Number	E20198RE50560665
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		signed4820_001US9_NFOA_TD_SIDS_POA.pdf	3749334 3355db39c8a7c416e143b549b52166d289d27972	yes	22

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Amendment/Req. Reconsideration-After Non-Final Reject	2	2
Claims	3	8
Applicant Arguments/Remarks Made in an Amendment	9	15
Miscellaneous Incoming Letter	16	17
Information Disclosure Statement (IDS) Form (SB08)	18	18
Terminal Disclaimer Filed	19	19
Power of Attorney	20	20
Assignee showing of ownership per 37 CFR 3.73	21	22

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	31905 4806a2ba89848165c078cc891c307b51c4ba62fe	no	2

Warnings:

Information:

Total Files Size (in bytes):	3781239

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	November 21, 2019
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Amendment and Response under 37 C.F.R. § 1.111 (14 pgs.)
X Information Disclosure Statement (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (6).
X Authorization to charge Deposit Account 19-0743 in the amount of $240.00 to cover the fee for consideration of Information Disclosure Statement under 37 C.F.R. § 1.97(c).
X Terminal Disclaimer (1 pg.)
X Authorization to charge Deposit Account 19-0743 in the amount of $160.00 to cover the fee for the Terminal Disclaimer
X Power of Attorney (1 pg.)
X Statement Under 37 CFR 3.73(c) (2 pgs.)

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

/By Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Amber Orlando
Serial No.: 15/974,343	Group Art Unit: 1776
Filed: May 8, 2018	Docket No.: 4820.001US9
Customer No.: 21186	Confirmation No.: 1072

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.111

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

In response to the Office dated January 14, 2019, please amend the application as follows:

IN THE CLAIMS

Please amend the claims as follows:

1-26. (Canceled)

27. (Previously Presented) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein

the coal comprises added Br_2, HBr, a bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises added Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;

contacting mercury in the mercury-containing gas with the sorbent; and

separating the sorbent contacted with the mercury from the mercury-containing gas.

28. (Previously Presented) The method of claim 27, wherein the coal comprises the added Br_2, HBr, the bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber.

29. (Previously Presented) The method of claim 27, wherein the combustion chamber comprises the added Br_2, HBr, the bromide compound, or a combination thereof.

30. (Previously Presented) The method of claim 27, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the Br_2, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein

the addition of the Br_2, HBr, bromide compound, or combination thereof, to the coal is performed at the coal-combustion facility.

31. (Previously Presented) The method of claim 27, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the Br_2, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the Br_2, HBr, bromide compound, or combination thereof, to the coal is performed at a site other than the coal-combustion facility.

32. (Previously Presented) The method of claim 27, wherein the combustion chamber is an electric utility coal combustion chamber.

33. (Previously Presented) The method of claim 27, wherein the combustion chamber is a coal combustion furnace.

34. (Previously Presented) The method of claim 27, wherein the coal comprises a subbituminous coal.

35. (Previously Presented) The method of claim 27, wherein the coal comprises a lignite coal.

36. (Previously Presented) The method of claim 27, further comprising

measuring the mercury content of the mercury-containing gas; and

modifying, in response to the measured mercury content of the mercury-containing gas,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

37. (Previously Presented) The method of claim 36, wherein the measuring of the mercury content comprises continuous measurement.

38. (Previously Presented) The method of claim 27, further comprising:

modifying, in response to a measured mercury content,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

39. (Previously Presented) The method of claim 27, wherein the mercury-containing gas comprises about 1 g to about 30 g of the element bromine per 100 g of the sorbent.

40. (Previously Presented) The method of claim 27, wherein the sorbent contacted with the mercury comprises the element bromine and mercury.

41. (Previously Presented) The method of claim 27, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas.

42. (Previously Presented) The method of claim 27, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas with the sorbent.

43. (Previously Presented) The method of claim 27, wherein the sorbent in the mercury-containing gas comprises about 1 g to about 30 g of the added Br_2, HBr, the bromide compound, or a combination thereof, per 100 g of the sorbent.

44. (Previously Presented) The method of claim 27, wherein the Br_2, HBr, or the bromide compound is contacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.

45. (Previously Presented) The method of claim 27, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.

46. (Previously Presented) The method of claim 27, wherein the sorbent injected into the mercury-containing gas is a sorbent obtained by contacting a sorbent with a halogen or halide promoter prior to the injection of the sorbent into the mercury-containing gas.

47. (Previously Presented) The method of claim 27, wherein the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.

48. (Previously Presented) The method of claim 27, wherein the combustion chamber comprises a boiler.

49. (Previously Presented) The method of claim 27, wherein the mercury-containing gas is a flue gas.

50. (Previously Presented) The method of claim 27, wherein the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator, a scrubber, or a combination thereof.

51. (Previously Presented) The method of claim 50, wherein the particulate separator comprises a baghouse, a an electrostatic precipitator, a fabric filter, or a combination thereof.

52. (Previously Presented) The method of claim 27, wherein a halide sorbent enhancement additive comprises the added Br_2, HBr, bromide compound, or combination thereof.

53. (Previously Presented) The method of claim 52, wherein the sorbent enhancement additive comprises the bromide compound.

54. (Previously Presented) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br^-, or a combination thereof, wherein

the coal comprises added Br_2, HBr, a bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises added Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;

contacting mercury in the mercury-containing gas with the sorbent; and

separating the sorbent contacted with the mercury from the mercury-containing gas.

55. (Previously Presented) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br^-, or a combination thereof, wherein

the coal comprises added Br_2, HBr, a bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises added Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent;

contacting mercury in the mercury-containing gas with the promoted sorbent;

separating the promoted sorbent contacted with the mercury from the mercury-containing gas;

measuring the mercury content of the mercury-containing gas; and

modifying, in response to the measured mercury content,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

REMARKS

This responds to the Office Action dated January 14, 2019.

No claims are amended, no claims are canceled, and no claims are added; as a result, claims 27-55 are now pending in this application.

Allowable Subject Matter

The Office Action states:

> The arguments filed 07/10/2019 regarding claims 27-55 with regard to the 103(a) rejections are found to be persuasive. Once the applicant timely files terminal disclaimers to overcome the pending double patenting rejections the claims will be in condition for allowance.

Applicant thanks the Examiner for indicating allowable subject matter. Terminal disclaimers are submitted herewith to obviate the double patenting rejections, as explained below.

Double Patenting Rejections

I. Double patenting rejections.

V(A). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-30 of U.S. patent no. 7,435,286 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-30 of U.S. patent no. 7,435,286 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(B). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-25 of U.S. patent no. 8,168,147 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-25 of U.S. patent no. 8,168,147 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(C). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-60 of U.S. patent no. 8,512,655 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-60 of U.S. patent no. 8,512,655 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(D). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-60 of U.S. patent no. 8,821,819 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-60 of U.S. patent no. 8,821,819 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(E). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-33 of U.S. patent no. 9,757,689 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-33 of U.S. patent no. 9,757,689 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(F). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of U.S. patent no. 9,468,886 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of U.S. patent no. 9,468,886 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(G). The Office Action rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-30 of U.S. patent no. 8,652,235 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-30 of U.S. patent no. 8,652,235 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(H). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-16 of copending application no. 15/295,594 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-16 of copending application no. 15/295,594 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(I). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 8-20 of copending application no. 15/589,359.

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 8-20 of copending application no. 15/589,359. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(J). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/853,029 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of copending application no. 15/853,029 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(K). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 14/712,558.

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of copending application no. 14/712,558. However, merely to expedite

prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(L). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/951,970.

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of copending application no. 15/951,970. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(M). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/382,114 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of copending application no. 15/382,114 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(N). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/853,029 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of copending application no. 15/853,029 in view of Felsvang and Nelson. This rejection appears to be a duplicate of the rejection listed herein at **V(J)**. However,

merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

V(O). The Office Action provisionally rejected claims 27-55 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/978,760 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 27-55 are obvious over claims 1-20 of copending application no. 15/978,760 in view of Felsvang and Nelson. However, merely to expedite prosecution, a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321 is enclosed herewith to obviate these rejections.

Applicant therefore respectfully requests reconsideration and withdrawal of the double patenting rejection.

CONCLUSION

Applicant respectfully submit that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone the undersigned at (612) 349-9580 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, Minnesota 55402
(612) 373-6900

Date August 28, 2019

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Amber Orlando
Serial No.: 15/974,343	Group Art Unit: 1776
Filed: May 8, 2018	Docket: 4820.001US9
Customer No.: 21186	Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(c)(2), Applicant hereby authorizes the Commissioner to charge the fee of $240.00 as set forth in 37 C.F.R. § 1.17(p), to Deposit Account No. 19-0743. Please charge any additional fees or deficiencies, or credit any overpayment to Deposit Account No. 19-0743.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date August 28, 2019

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:bam

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 08/21/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
08/21/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Office Action Summary	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA (FITF) 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 07/10/2019.

☐ 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) 27-55 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) 27-55 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 _____ 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

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 07/17/2019 has been entered.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application,

or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 27-55 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. US 7,435,286 ('286) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '286 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '286 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-25 of U.S. Patent No. US 8,168,147 ('147) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '147 except the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '147 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-60 of U.S. Patent No. US 8,512,655 ('655) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '655 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '655 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-60 of U.S. Patent No. US 8,821,819 ('819) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '819 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '819 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-33 of U.S. Patent No. US 9,757,689 ('689) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '689 except the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '689 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of U.S. Patent No. US 9,468,886 ('886) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '886 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '886 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. 8,652,235 ('235) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '235 except the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '235 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of copending Application No. 15/295594 ('594) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '594 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '594 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 8-20 of copending Application No. 15/589359 ('359).

Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording it the limitations correspond to '359.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/853029 ('029) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '029 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '029 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof

(Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 14/712558 ('558) Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording it the limitations correspond to '558.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/951970 ('970). Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording, the limitations correspond to '970.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/382114 ('114) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '114 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereofs.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '114 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/853029 ('029) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '029 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '029 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 27-55are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/978,760 ('760) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '760 except for the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof.

Felsvang et al. and Nelson references disclose this limitation as shown previously.

It would have been obvious to one having ordinary skill in the art to have modified the '760 reference to include the coal comprises Br_2, HBr, a bromide compound or a combination thereof, or the combustion chamber comprises added Br_2, HBr, a bromide compound or a combination thereof (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Allowable Subject Matter

The arguments filed 07/10/2019 regarding claims 27-55 with regard to the 103(a) rejections are found to be persuasive. Once the applicant timely files terminal disclaimers to overcome the pending double patenting rejections the claims will be in condition for allowance.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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.

AMBER ROSE. ORLANDO
Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO
Inventor Search (EAST)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	01/07/2019	AO
IDS Search (DAV and EAST)	08/17/2019	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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/AMBER R ORLANDO/ 08/17/2019

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

	1	"Application Serial No. 15 589,359, Response filed 04-30-19 to Final Office Action mailed 03-01-19", 11 pgs.	
	2	"Application Serial No. 15 589,359, Final Office Action mailed 03-01-19", 10 pgs	
	3	"Control of Mercury Emissions from Coal Fired Electric Utility Boilers: An Update", US EPA Air Pollution Prevention and Control Division, National Risk Management Research Laboratory, Office of Research and Development, (February 18, 2005), 59 pgs	
	4	"Sorbent Enhancement Additives for Mercury Control", US DOE Office of Fossil Energy, National Energy Technology Laboratory, (June 2008), 4 pgs	
	5	"Application Serial No. 15 978,760, Ex Parte Quayle Action mailed 04-19-19", 13 pgs	
	6	"Application Serial No. 15 295,594, Response filed 4-23-19 to Non Final Office Action mailed 10-23-18", 45 pgs	
	7	"Application Serial No. 15 978,760, Response filed 4-23-19 to Ex Parte Quayle Action mailed 04-19-19", 15 pgs	
	8	"Application Serial No. 15 978,760, Notice of Allowance mailed 05-08-19", 7 pgs	
	9	"Coal Combustion Products (CCPs): Characteristics, Utilization and Beneficiation", Edited by Tom Robl, et al., Woodhead Publishing (Elsevier), (2017), 565 pgs	
	10	"Application Serial No. 15 589,359, Advisory Action mailed 05-22-19", 3 pgs	
	11	"Application Serial No. 15 382,114, Response filed 3-12-19 to Non Final Office Action mailed 12-12-18", 24 pgs	

/AMBER R ORLANDO/ 08/17/2019

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

	12	"Application Serial No. 15 978,760, Response filed 03-20-19 to Final Office Action mailed 12-26-18", 90 pgs.	
	13	BENSON, STEVEN A., "JV Task 73 - Mercury Control Technologies for Electric Utilities Burning Subbituminous Coals - Draft Final Report", University of North Dakota Energy and Environmental Research Center, (June 2005), 165 pgs	
	14	BENSON, STEVEN A., "Pilot-and Full-Scale Demonstration of Advanced Mercury Control Technologies for Lignite-Fired Power Plants", University of North Dakota Energy and Environmental Research Center, (February 2005), 97 pgs	
	15	BERRY, MARK, "Mercury control evaluation of calcium bromide injection into a PRB-fired furnace with an SCR", Proc. of the Air Quality VI Conference, Arlington, VA, (2007), 9 pgs	
	16	BROWN, THOMAS D., "Mercury Measurement and Its Control: What We Know, Have Learned, and Need to Further Investigate", Journal of the Air and Waste Management Association, 49(6), (June 1999), 98 pgs	
	17	FEELEY, THOMAS J., "A Review of DOE NETL's Mercury Control Technology R and D Program for Coal-Fired Power Plants", DOE NETL Hg R and D Program Review, (April 2003), 32 pgs	
	18	FRENCH, CHARLES L., "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units - Final Report to Congress: Volume 1", US EPA Office of Air Quality Planning and Standards, (February 1998), 502 pgs	
	19	GHORISHI, BEHROOZ S., "In-Flight Capture of Elemental Mercury by Chlorine-Impregnated Activated Carbon", Proc. of the 94th Annual Meeting of the Air and Waste Management Association, Orlando, FL, (June 2001), 14 pgs	
	20	JONES, ANDREW P., "DOE NETL's Phase II Mercury Control Technology Field Testing Program: Preliminary Economic Analysis of Activated Carbon Injection", Environmental Science and Technology, 41(4), (2007), 7 pgs	
	21	KEATING, MARTHA H., "Mercury Study Report to Congress Volume 1: Executive Summary", US EPA Office of Air Quality Planning and Standards, (December 1997), 95 pgs	
	22	KILGROE, JAMES D., "Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report", US EPA Office of Research and Development, National Risk Management Laboratory, Air Pollution Prevention and Control Division, (December 2001), 485 pgs	

/AMBER R ORLANDO/ 08/17/2019

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

	23	NELSON, SID JR., "How China Can Leapfrog the World in Mercury Emission Reductions", Proc. of the AWMA Intl. Specialty Conference on Leapfrogging Opportunities for Air Quality Improvement, (2010), 24 pgs
	24	PAVLISH, JOHN H., "Status review of mercury control options for coal-fired power plants", Fuel Processing Technology, Vol. 82, (2003), 77 pgs
	25	YANG, YANG, "Effect of HBr formation on mercury oxidation via CaBr(2) addition to coal during combustion", RSC Advances, 6(64), (2016), 7 pgs

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/AMBER R ORLANDO/	Date Considered	08/17/2019

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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	/Nicholas P. Lanzatella/	Date (YYYY-MM-DD)	2019-05-23
Name/Print	Nicholas P. Lanzatella	Registration Number	63,803

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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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.

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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.

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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.

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"20120100053"	US-PGPUB; USPAT	ADJ	ON	2019/08/17 11:40
L2	1	"20130157845"	US-PGPUB; USPAT	ADJ	ON	2019/08/17 11:40
S1	45	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S2	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorben and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S3	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:20
S7	73	("20020150516" | "4786483" | "5409522" | "5505766" | "6383981" | "6878358" | "20020033097" | "4530765" | "5346674" | "6080281" | "4708853" | "6027551" | "6136072" | "6258334" | "6818043" | "20060057044" | "20080207443" | "20010002387" | "3826618" | "4814152" | "4820318" | "4889698" | "5891324" | "6528030" | "20050227146" | "5419834" | "7942566" | "20080134888" | "3662523" | "3849267" | "4196173" | "4500327" | "6942840" | "20020134242" | "20030136509" | "20050147549" | "20060112823" | "20080134888" | "6471936" | "20010003116" | "20050019240" | "20060048646" | "4956162" | "5575982" | "6372187" | "6375909" | "7435286" | "7514052" | "20050074380" | "20090081092" | "5288306" | "1984164" | "4101631" | "5695726" | "6080281" | "6848374" | "20050000197" | "5300137" | "5607496" | "5672323" | "6214304" | "6953494" | "5245120" | "20070168213" | "7938571" | "20040003716" | "20040013589" | "3194629" | "3786619" | "5827352" | "20040109800" | "20070295347" | "5435980" | "6136749" | "20030206846").PN.	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:25
S8	13	"11209163"	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S9	3	"11209163" and non carbon	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S10	161	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10,	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:49

		B01D53/10).cpc. and (halogen or halide of HBr) with sorbent				
S11	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S12	116	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S13	172	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S14	67	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S15	67	"6136749"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:11
S16	20	"684374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S17	1	"20040003716"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S18	68	"6848374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S19	41	"7435286"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S20	13	"8168147"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S21	69	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S22	181	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S25	28	"5266280"	US-PGPUB; USPAT	ADJ	ON	2016/06/07 13:41
S26	281	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:01
S27	148	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:02
S28	159	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:18

S29	206	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:22
S30	195	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/09/30 13:48
S33	6	"20040003719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:56
S34	49	"2004003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:57
S35	81	"6848374"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:58
S36	56	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:02
S37	7	olson.in. and ("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:04
S38	0	("40" microns and halocarbon sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S39	0	(halocarbon sorbent).clm. and "40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S40	65	"40" microns and olson.in.	US-PGPUB;	ADJ	ON	2016/11/16

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S41	3907	("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S42	29	("40" microns and sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S43	1	(halocarbon sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S44	36	(sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S45	0	(sorbent).clm. and olson.in. and "40" micron	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S46	17	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:09
S47	2	"20110233133"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:27
S48	7	"20110023427"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	ADJ	ON	2016/11/16 11:28

			IBM_TDB			
S49	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S50	11	"20040025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S51	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S52	40	"6312489"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S53	30	("20030024872" | "20050045553" | "20050144916" | "4008060" | "4640779" | "4655921" | "4673503" | "4738778" | "4746432" | "4799944" | "5043000" | "5051118" | "5120296" | "5174896" | "5320657" | "5512075" | "5674302" | "6152979" | "6312489" | "6315130" | "6336946" | "6398836" | "6585793" | "6598749" | "7648546").PN. OR ("7931723").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:36
S54	33	("4200444" | "4640779" | "5968215" | "6059851").PN. OR ("6312489").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:40
S55	5	"8518142"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:54
S56	4	"8747505"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:57
S57	2	"14318270"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 12:06
S58	13	pac with size with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 12:13
S59	197	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10,	US-PGPUB; USPAT	ADJ	ON	2016/11/16 15:23

		B01D53/10).cpc. and (halogen or halide of HBr) with sorbent				
S60	0	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent "4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S61	10	"4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S62	0	"2010083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S63	2	"20100083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S64	2	absorp$5 with mea with methanol with acid	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:36
S65	2	"20070283813"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:39
S66	21	"4469596"	US-PGPUB; USPAT	ADJ	ON	2016/11/21 08:29
S67	4	"2003229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S68	2	"20030229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S69	45	"5,338,458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S70	45	"5338458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S71	213	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:02
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S79	3	("20090235848" | "20110076210" | "20140224121").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:36
S80	96	("1984164" | "2317857" | "20010002387" | "20010003116" | "20020043496" | "20020134242" | "20020150516" | "20030104937" | "20030136509" | "20040003716" | "20040013589" | "20040076570" | "20050019240" | "20060048646" | "20060191835" | "20080182747" | "20080292512" | "20090062119" | "20090136401" | "20090320678" | "20100047146" | "20110168018" | "20120183458" | "20130280156" | "20140056787" | "20140255279" | "20140308188" | "20150098878" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "3876393" | "4094777" | "4101631" | "4196173" | "4338896" | "4500327" | "4708853" | "4786483" | "4814152" | "4820318" | "4889698" | "4956162" | "5300137" | "5336835" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" | "5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6638485" | "6808692" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "6960329" | "7081434" | "7211707" | "7435286" | "7479263" | "7514052" | "7521032" | "7544338" | "7563311" | "7611564" | "7622092" | "7722843" | "7767174" | "7780765" | "8007749" | "8168147" | "8168149" | "8216535" | "8512655" | "8652235" | "8821819" | "9011805").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:41
S81	593	honeycomb with plug$4 and plug$4 with length	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S82	0	honeycomb with plug$4 and plug$4 with length with less than with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S83	0	honeycomb with plug$4 and plug$4 with length with less than	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S84	127	honeycomb with plug$4 and plug$4 with	US-PGPUB;	ADJ	ON	2017/06/27

		length with "5"	USPAT			14:46
S85	241	honeycomb with plug$4 and plug$4 with length with mm	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:47
S86	41	honeycomb with plug$4 and plug$4 with length with "3 mm "	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:49
S87	28	honeycomb with plug$4 and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:52
S88	28	honeycomb and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:53
S89	43	honeycomb and plug$4 with porosity with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:06
S90	20	honeycomb and plug$4 with pore (size or diameter) with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:07
S91	8	saw with honeycomb with filter	US-PGPUB; USPAT	ADJ	ON	2017/06/29 13:31
S92	230	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/12/01 14:36
S93	2	"20060260468"	US-PGPUB; USPAT	ADJ	ON	2018/07/03 10:34
S94	19	engine with air with inlet with filter$4 with cone	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:26
S95	36	engine with air with inlet with filter$4 with (cone or conical or (diameter with (increas$4 or decreas$4)))	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:27
S96	24	("3771638" | "3870495" | "3872012" | "4157902" | "4702754" | "5125940" | "5522909" | "5549724" | "5632793").PN. OR ("5888260").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S97	41	("0153535" | "0439091" | "1398685" | "1530163" | "1887052" | "2087688" | "4003836" | "4018580" | "4032455" | "4039308" | "4065276" | "4261710" | "4410341" | "4414110" | "4699715" | "5106397" | "5178656" | "5522909" | "5549722" | "5549724" | "5888260" | "6397842" | "6508052" | "D401597" | "D401942" | "D403414" | "D403416").PN. OR ("6808552").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S98	15	("D403416").URPN.	USPAT	ADJ	ON	2018/07/03 15:33
S99	0	"20030089233"	USPAT	ADJ	ON	2018/07/04 12:29
S100	3	"20030089233"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S101	26	"6833023"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S102	2	"20070168213"	US-PGPUB; USPAT;	ADJ	ON	2018/07/09 13:08

			USOCR; FPRS; EPO; JPO			
S103	14	carbocations with sorbent with bromine	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:14
S104	0	a side forming a cross sectional shape of each of the first	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:47
S105	0	non of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S106	0	none of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S107	0	none of sides forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S109	13	olson.in. and (alkali and promoter and earth).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S110	0	olson.in. and (alkali and promoter and earth with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S111	10	olson.in. and (alkali and promoter with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S112	0	"2015008283"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S113	2	"20150082833"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S114	24	olson.in. and liquid.clm. and promoted	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:50
S115	75	remov$4 with mercury and (br or bromine) with liquid with carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:54
S116	0	separating greater than "70" wt% of the mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S117	0	((separating greater) with (of the mercury)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17

S118	20	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:43
S119	40	(during with after with mercury with sorbent)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:38
S120	304	sorbent with mercury and sorbent with boiler	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:39
S121	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:41
S122	18	before with burn$4 with coal with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:42
S123	204	("0174348" | "0202092" | "0208011" | "0224649" | "0229159" | "0298727" | "0346765" | "0347078" | "0367014" | "0537926" | "0537998" | "0541025" | "0625754" | "0647622" | "0685719" | "0688782" | "0700888" | "0744908" | "0846338" | "0894110" | "0896876" | "0911960" | "0945331" | "0945846" | "1112547" | "1167471" | "1167472" | "1183445" | "1788466" | "1984164" | "20020065581" | "20020114749" | "20020184817" | "20030088370" | "20030103882" | "20040003716" | "20040013589" | "20040086439" | "20040219083" | "20050039598" | "20060047526" | "20060210463" | "2016821" | "2059388" | "2089599" | "2511288" | "3194629" | "3288576" | "3437476" | "3599610" | "3662523" | "3725530" | "3764496" | "3823676" | "3838190" | "3849267" | "3849537" | "3956458" | "3961020" | "3974254" | "4040802" | "4075282" | "4094777" | "4101631" | "4115518" | "4148613" | "4174373" | "4196173" | "4226601" | "4233274" | "4272250" | "4280817" | "4305726" | "4322218" | "4377599" | "4387653" | "4394354" | "4440100" | "4472278" | "4474896" | "4519807" | "4519995" | "4555392" | "4582936" | "4602918" | "4629721" | "4693731" | "4716137" | "4741278" | "4758418" | "4764219" | "4786483" | "4804521" | "4807542" | "4824441" | "4830829" | "4873930" | "4886519" | "4892567" | "4915818" | "4933158" | "4936047" | "4964889" | "5013358" | "5024171" |	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/01 17:42

		"5049163" | "5116793" | "5126300" | "5137854" | "5162598" | "5190566" | "5238488" | "5350728" | "5368617" | "5409522" | "5435980" | "5447703" | "5460643" | "5505746" | "5505766" | "5571490").PN. OR ("5587003" | "5618508" | "5635150" | "5659100" | "5670122" | "5733516" | "5738834" | "5787823" | "5810910" | "5897688" | "5910292" | "5989506" | "6024931" | "6083289" | "6240859" | "6258334" | "6372187" | "6375909" | "6475451" | "6521021" | "6528030" | "6533842" | "6558454" | "6610263" | "6613110" | "6719828" | "6732055" | "6737031" | "6746531" | "6790420" | "6808692" | "6848374" | "6878358" | "6942840" | "6953494" | "6962617" | "6974564" | "6975975" | "7468170" | "7507083" | "7674442" | "7758827" | "7776301").PN.				
S124	1	"15573128"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:07
S125	2	"20110207597"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:08
S126	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S127	71	sorbent with before with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S128	234	"6953494"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:38
S129	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:40
S130	35	promoter with sorbent and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S131	28	promoter with sorbent with mercury and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S132	4	promoter with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:20

S133	4	promot$4 with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:23
S134	4	promot$4 with sorbent with mercury and pre.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:41
S135	2	promot$4 with sorbent with mercury and pre-heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:42
S136	2	promot$4 with sorbent with mercury and pre heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S137	57	promot$4 with sorbent with mercury and pre	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S138	24	sorbent with preheat$4 with coal	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:39
S139	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:47
S140	23	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:28
S141	5	"14102896"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:48
S142	7	"12429058"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:09
S143	4	"12202595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:23
S144	20	"12201595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:24

S145	3	"14564860"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:27
S146	1	"15978760"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:28
S147	1	"15589359"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:32
S148	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:37
S149	8	"15997091"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S150	6	"14712558"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S151	2	"15951970"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:18
S152	4	"15382114"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:47
S153	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:51
S154	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:18
S155	69	"4279873"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:42
S156	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 07:59

S157	4	"15295594"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 08:08
S158	1	("20180257030").PN.	US-PGPUB; USPAT	ADJ	ON	2018/10/04 09:31
S159	86	"5569436"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:32
S160	6	"5785935"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S161	8	"6475471"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S162	53	"6103205"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:46
S163	0	pyrolysis with char with mercury with activated	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S164	17	pyrolysis with char with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S165	121	pyrolysis with char with activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S166	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S167	43	pyrolysis with char with activated carbon and mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S168	118	pyrolysis with char with tire	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S169	58	pyrolysis with char with activated carbon and mercury	US-PGPUB; USPAT; USOCR;	ADJ	ON	2018/10/04 12:04

			FPRS; EPO; JPO			
S170	8	"20040081724"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 15:07
S171	4	"14128179"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 15:10
S172	84	activat$4 carbon with boiler with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S173	88	activat$4 carbon with boiler with coal and (remov$4 or filter$4 or absorb$4 or adsorb$4) with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S174	0	mercury with stabiliz$4 with sulfer dioxide	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 14:23
S175	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 15:07
S176	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:48
S177	17	"8821819"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:51
S178	15	"8652235"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:55
S179	93	"6136749"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/24 09:08
S180	4	"9757689"	US-PGPUB; USPAT	ADJ	ON	2018/10/24 12:37
S181	9	"8939388"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 09:59

S182	669	urea with inject$4 with filter$4 with exhaust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:15
S183	2	urea with inject$4 with filter$4 with exhaust and urea with quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:16
S184	13	"3615165"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:35
S185	136	urea with quench$4 with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:39
S186	48	urea dust with scrub$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 11:25
S187	38	"6221155"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 12:04
S188	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 14:12
S189	773	ammonium with remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:14
S190	108	ammonium with salt with remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:15
S191	45	ammonium with salt with remov$4 with mercury and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:15
S192	42	"5556447"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:21
S193	174	"4500327"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:21

S194	72	"4500327" and ammonium	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:23
S195	3	anionic couterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S196	3480	anionic counterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S197	2422	anionic counterion and ammonium with salt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S198	9	anionic counterion and ammonium with salt and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S199	52	"6960329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:50
S200	4	"20040003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/06 11:23
S201	1	"45219176".FMID.	US-PGPUB; USPAT; FPRS	ADJ	ON	2018/12/06 13:32
S202	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/01/07 09:41
S203	284	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2019/04/15 14:29
S204	88	activat$4 carbon with boiler with coal and (remov$4 or filter$4 or absorb$4 or adsorb$4) with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/04/15 14:29
S205	42	"6132790"	US-PGPUB; USPAT	ADJ	ON	2019/06/12 16:06
S206	19	remov$4 with mercury and calcium nitrate with sorbent	US-PGPUB; USPAT	ADJ	ON	2019/06/12 16:55

S207	1	remov$4 with mercury with calcium nitrate	US-PGPUB; USPAT	ADJ	ON	2019/06/12 16:57
S208	1	"20040146613"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/13 12:59
S209	71	("6372187").URPN.	USPAT	ADJ	ON	2019/06/18 10:24
S210	48	("6372187").URPN. and (iodide or HI)	USPAT	ADJ	ON	2019/06/18 10:25
S211	61	(iodide or HI) with inject$4 and mercury with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/18 10:30
S212	85	(iodide or HI) with coal and mercury with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/18 10:35
S213	131	"6558454"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/06/18 10:41
S214	5	"15295594"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 12:48
S215	82	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 16:29
S216	65	"4013516"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 21:01
S217	24	"4699896"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/07/30 21:01

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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,343,114	7/9/2019	Olson, Edwin S, et al.
	US-20120100053A1	4/26/2012	Durham, Michael D, et al.
	US-20130157845A1	6/20/2013	Nalepa, Christopher J, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	WO-2012030560A1	3/8/2012	Nalepa, Christopher J, et al.	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 15/382,114, Final Office Action mailed 06-21-19", 31 pgs	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 06-21-19", 7 pgs	
	"Application Serial No. 15/978,760, Notice of Allowability mailed 05-30-19", 3 pgs	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 08/17/2019

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

S/N 15/974,343 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION CONCERNING PRIOR OR COPENDING APPLICATION(S)

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

Pursuant to the guidance of MPEP §§ 2001.06(b) and 2004(9), Applicant would like to bring the following additional application(s) to the Examiner's attention. The identification of these applications is not intended to suggest that the subject matter claimed in any listed application is, or has been, substantially similar to any claim or claims in the present application.

Serial No./ Patent No.	Filing Date	Attorney Docket	Title
15/997,091	June 4, 2018	4820.001U10	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
16/130,670	September 13, 2018	4820.005US2	SORBENT COMPRISING CARBON AND NITROGEN AND METHODS OF USING THE SAME

Respectfully submitted,

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Date 02/26/2019 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

/AMBER R ORLANDO/ 08/17/2019

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 07/16/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
07/16/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 15/974,343	**Applicant(s)** Olson et al.	
	Examiner BRIAN W BROWN	**Art Unit** OPET	**AIA (FITF) Status** No

1. THE REQUEST FILED 10 July 2019 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☐ for an original nonprovisional application (Track I).
B. ☑ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination.** The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to BRIAN BROWN at (571)272-5338.

In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/BRIAN W BROWN/ Petitions Examiner, OPET	

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e)

(Page 1 of 1)

First Named Inventor:	Edwin S. Olson	Nonprovisional Application Number (if known):	15/974,343
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	Docket No.:	4820.001US9

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. **Request for Continued Examination – Prioritized Examination under § 1.102(e)(2)**

   i. A request for continued examination has been filed with, or prior to, this form.
   ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
   iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C 371.
   iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
   v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Nicholas P. Lanzatella/	Date July 10, 2019
Name (Print/Typed) Nicholas P. Lanzatella	Practitioner Registration Number: 63,803

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

*Total of 1 forms are submitted.

REMARKS

This responds to the Final Office Action dated January 14, 2019.

No claims are presently amended. Claims 1-10, 14, and 21-26 are presently canceled, and claims 11-13 and 15-20 were canceled previously. New claims 27-55 are presently added. As a result, claims 27-55 are now pending in this application.

New claim	Prior claim or other support from published U.S. application
27	1
28	2, FIG. 11, and [0217]
29	FIG. 11 and [0217]
30	Example 10 at [0122]
31	[0077] and [0202]
32	[0069]
33	[0112]
34	[0105]
35	[0123]
36	25, [0090]
37	[0090]
38	25, [0090]
39	24
40	FIG. 2
41	22
42	23
43	24
44	[0015] and [0051]
45	14
46	[0047]
47	[0123]
48	[0217]
49	[0003]
50	[0058] and FIG. 11
51	[0109]
52	[0007], [0053], [0072], [0188], [0199]
53	[0007], [0053], [0072], [0188], [0199]
54	1
55	1, 25, [0090]

Independent claims 27, 54, and 55 recite combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the coal or the combustion chamber comprises added

Br_2, HBr, a bromide compound, or a combination thereof; injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber; contacting mercury in the mercury-containing gas with the sorbent; and separating the sorbent contacted with the mercury from the mercury-containing gas. As explained herein at parts **I-IV**, this combination of features is patentable over the cited references. Dependent claims 28-53 are directly or indirectly dependent on independent claim 27. As such, these dependent claims incorporate all the features of claim 27. Accordingly, claims 28-53 are patentable for at least the reasons given herein for patentability of independent claim 27.

37 CFR §1.132 Declarations

A 37 CFR § 1.132 declaration by John Pavlish filed with the Response of 3/20/2019 for U.S. patent application no. 15/978,760 is submitted herewith that describes objective evidence of nonobviousness ("Declaration A"). The 37 CFR § 1.132 declaration by John Pavlish submitted with the last response was revised and filed with the Response of 3/20/2019 for U.S. patent application no. 15/978,760 and is submitted herewith ("Declaration B"). A 37 CFR § 1.132 declaration by John Pavlish and Nicholas Lentz filed with the Response of 3/20/2019 for U.S. patent application no. 15/978,760 is submitted herewith that explains that Br_2 is not HBr and does not include HBr, and Cl_2 is not HCl and does not include HCl; that Br_2 is not and does not include Br^-, and Cl_2 is not and does not include Cl^-; NaBr is a salt that includes Na^+ ions and Br^- ions; and that NaCl is a salt that includes Na^+ ions and Cl^- ions ("Declaration C"). A 37 CFR § 1.132 declaration by John Pavlish filed with the Response of 3/20/2019 for U.S. patent application no. 15/978,760 is submitted herewith that explains that data from Nelson's experimental setup and from the pilot-scale unit of item 8 of Declaration B are validly comparable ("Declaration D").

Summary of Arguments

Response to Examiner's Rejection under 35 USC § 103

The claims were rejected over Felsvang in view of Nelson based on the Examiner's assessment that Felsvang teaches in-flight sorbent promotion using a chlorine-based material and Nelson teaches that bromine-based materials are superior for promoting sorbents. This was,

respectfully, in error. As explained below, the Examiner has not established a *prima facia* case of obviousness.

The Cited Refences Do Not Provide a Motivation to Attempt In-Flight Promotion With HBr or Br^- Over Pre-Treatment of Sorbents

As an initial matter, while Felsvang does mention supplying chloride to coal and providing activated carbon in flue gas, Felsvang does not teach that this process promotes the activated carbon. The Examiner fails to identify any teaching in the art that exposure of activated carbon to halogen- or halide-containing flue gas (as opposed to, e.g., concentrated halogen or halide gas) would generate a promoted sorbent, as opposed to, for example, the activated carbon and the halogen or halide in the flue gas providing independent, albeit complementary, mechanisms for mercury removal. For example, a person with a cold may expect aspirin and a decongestant to work well together at reducing symptoms, but that does not mean that taking the two compounds together will cause an additional beneficial chemical reaction.

To be sure, writing a decade later, Sidney Nelson acknowledges that chlorine and bromine can be used to promote carbon sorbents in-flight in the flue gas.[1] But, as the Examiner acknowledges, the Nelson reference does not teach in-flight promotion in the flue gas as a way to create a promoted sorbent, nor does Nelson teach adding any chemical to the flue gas would improve mercury removal. Quite the contrary, Nelson describes pre-treating sorbent (i.e., outside of flue gas) as an "essential element" of his invention.[2] He offers specific reasons as to why pre-treatment was viewed as essential. For example, he notes that bromine species can be "quite corrosive,"[3] the carbon should be "uniformly exposed to and reacted with the bromine,"[4] the carbon should be purged of H_2O which interferes with bromination,[5] and he describes a mixing time for HBr and activated carbon of 90 minutes or more[6]. As explained more fully below, a person of

[1] Declaration A at item 18.
[2] Nelson at paragraph [0040].
[3] Nelson at paragraph [0044].
[4] Nelson at paragraph [0046].
[5] Nelson at paragraphs [0048] and [0051].
[6] Nelson at page 8, paragraph [0087] and the table at the top of the second column. For HBr-treated activated carbon, the adsorption rate was 1 gram of HBr absorbed per 1 kg of activated carbon per minute, or 0.1 wt% HBr absorbed per minute, meaning that to reach the 9 wt% HBr reported in the table required about 90 minutes. Note that Figure 14 reports results for 10 wt% HBr, and Figure 15 reports results for 9 wt% HBr. For Br_2-treated activated carbon, the adsorption rate was 10 grams of Br_2 absorbed per 1 kg of activated carbon per minute, or 1 wt% Br_2 absorbed per

ordinary skill in the art would recognize that the combustor and flue gas ductwork are composed of corrodible metal, the concentration of halogen in the flue gas would be low, the flue gas would contain significant H_2O (e.g., 7% as per Nelson)[7], and that in-flight mixing would allow for only several seconds of contact time between the activated carbon and the promoter rather than 90 minutes. Thus, Nelson would motivate a person of ordinary skill in the art to promote sorbents in a controlled setting outside of a flue gas, not to attempt in-flight promotion in a flue gas. At the very least, Examiner has not shown that a person of ordinary skill in the art would be motivated to modify Felsvang in view of Nelson.

Objective Evidence Confirms the Patentability of the Claims

The arguments above are reflected in the story of the claimed invention. Submitted herewith is the 37 CFR § 1.132 declaration by inventor John Pavlish that describes objective evidence of nonobviousness ("Declaration A"). Mr. Pavlish explains—with support from extensive contemporaneous documentation—how the EPA kicked off a race for the development of new mercury removal technologies. From early on though, the conventional wisdom was that sorbents should be pre-treated before injection into the flue gas. While at the Energy & Environmental Research Center ("EERC"), Mr. Pavlish and his co-inventors fought against this conventional wisdom and eventually obtained millions of dollars in federal grant money to develop the claimed invention. Their efforts were so successful that the Department of Energy specifically highlighted their work as a significant achievement. Since then, this technology has been recognized as one of the most widely adopted technologies for mercury control in the U.S.

The claimed invention has had such a significant impact on the industry, that even Sidney Nelson himself (the author of the Nelson reference) eventually touted the benefits of in-flight promotion in the flue gas with bromine. In doing so, he acknowledged that this approach differed from the conventional approach of pre-treating sorbent, and he specifically cited the work of the EERC as demonstrating the benefits of in-flight promotion in the flue gas with bromine. This objective evidence of non-obviousness further establishes the patentability of these claims. *Crocs,*

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minute, meaning that to reach the 15 wt% Br_2 reported in the table required about 15 minutes. Note that Figures 14 and 15 report results for 1.5 wt%, 5 wt%, and 15 wt% Br_2, according to the table requiring about 1.5 to 15 minutes to form.

[7] Nelson at paragraph [0079].

Inc. v. Int'l Trade Comm'n, 598 F.3d 1294, 1310 (Fed. Cir. 2010) (internal quotation marks omitted) (objective evidence "can be the most probative evidence of nonobviousness in the record, and enables the court to avert the trap of hindsight").

What follows is a detailed description of support for the arguments above, rebuttal evidence showing that the presently claimed invention has properties that could not be predicted from any cited reference, and responses to the Examiner's arguments.

Table of contents.

I. The Office Action rejected claims 1-3, 5-8, 14, and 21-26 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson"). 12

I(A). A person of ordinary skill in the art would not combine Nelson and Felsvang as alleged. ... 13

I(A)(1). Br_2 is not HBr and does not include HBr, and Cl_2 is not HCl and does not include HCl; also, Br_2 is not and does not include Br^-, and Cl_2 is not and does not include Cl^-. ... 14

I(A)(2). There would be no motivation for a person of ordinary skill in the art to use Nelson's HBr in place of Felsvang's HCl or Cl^- in Felsvang's process. ... 15

I(A)(2)(a). Felsvang focuses on HCl or Cl^- concentration in the flue gas. ... 16

I(A)(2)(b). A person of ordinary skill in the art would not combine Nelson with Felsvang as alleged because they would not know or expect in-flight promotion of the activated carbon sorbent would occur. 16

I(A)(2)(b)(i). A person of ordinary skill in the art would not combine Nelson with Felsvang as alleged because Felsvang fails to describe or suggest in-flight promotion can occur. ... 17

I(A)(2)(b)(ii). Promoter concentration in flue gas is low compared to during treatment outside of flue gas. 18

I(A)(2)(b)(iii). Contact time between promotors in the flue gas and activated carbon is very short compared to treatment outside the flue gas. 18

I(A)(2)(b)(iv). Consumption of hydrogen halides in the flue gas via corrosion or scavenging. ... 19

I(A)(2)(c). A person of ordinary skill in the art would not be motivated to use Felsvang's process with activated carbon. 20

I(A)(2)(d). Nelson provides no motivation to replace Felsvang's HCl or Cl^- treatment with Nelson's HBr treatment. 22

I(A)(3). Reply to Examiner's response to arguments. ... 42

I(B). In-flight promotion versus treatment outside the flue gas. ... 54

I(B)(1). In-flight promotion with HBr or Br^- promoters is more effective for mercury removal than treating the sorbent with HBr, Br^-, or Br_2 outside the mercury-containing gas. ... 54

I(B)(2). There is no way a person of ordinary skill in the art could predict that in-flight promotion of a sorbent with HBr or Br^- promoters is more effective for mercury removal than use of a sorbent that is treated with the same promoters outside the flue gas. 58

I(B)(3). Reply to Examiner's response to arguments. 60

I(C). In-flight promotion with HBr or Br^- versus HCl or Cl^- 64

I(C)(1). In-flight promotion with HBr or Br^- promoters is more effective for mercury removal than in-flight promotion with HCl or Cl^- promoters. 64

I(C)(2). There would be no way for a person of ordinary skill in the art to predict this advantage from the from the cited references. 66

I(C)(3). Reply to Examiner's response to arguments. 66

I(D). A person of ordinary skill in the art would find that treatment of activated carbon outside the flue gas with HCl as per Nelson's process actually provides more effective mercury removal per wt% HCl than treatment of activated carbon with HCl or Cl^- in the flue gas. 67

I(D)(1). Even if a person of ordinary skill in the art compared the mercury removal of Felsvang to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties per wt% HCl. 67

I(D)(2). Reply to response to arguments. 70

I(E). Objective evidence of non-obviousness of the claimed invention. 71

II. The Office Action rejected claim 4 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,848,374 ("Srinivasachar"). 72

III. The Office Action rejected claim 9 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,848,374 ("Srinivasachar"). 73

IV. The Office Action rejected claim 10 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,136,749 ("Gadkaree"). 74

V. Double patenting rejections. 75

The Rejection of Claims Under §103

I. The Office Action rejected claims 1-3, 5-8, 14, and 21-26 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed.

As explained herein at **I(A)**, a person of ordinary skill in the art would not combine Nelson and Felsvang as alleged. Part **I(B)** discusses in-flight promotion with HBr or Br^- in the flue gas versus treatment outside the flue gas. As explained herein at **I(B)(1)**, in-flight promotion with HBr or Br^- promoters is more effective for mercury removal than treating the sorbent with HBr, Br^-, or Br_2 outside the mercury-containing gas, and as explained herein at **I(B)(2)**, there would be no way for a person of ordinary skill in the art to predict this advantage from the cited references. Part **I(C)** discusses in-flight promotion in the flue gas with HBr or Br^- versus HCl or Cl^-. As explained herein at **I(C)(1)**, in-flight promotion with HBr or Br^- promoters is more effective for mercury removal than in-flight promotion with HCl or Cl^- promoters, and as explained herein at **I(C)(2)**, there would be no way for a person of ordinary skill in the art to predict this advantage from the cited references. Part **I(D)** explains that a person of ordinary skill in the art would find that treatment of activated carbon outside the flue gas with HCl as per Nelson's process actually provides more effective mercury removal per wt% HCl than treatment of activated carbon with HCl or Cl^- in the flue gas. As explained herein at **I(D)(1)**, even if a person of ordinary skill in the art compared the mercury removal of activated carbons promoted with HCl or Cl^- in the flue gas to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties per wt% HCl. Section **I(E)** discusses objective evidence of non-obviousness of the claimed invention. Sections **I(A)(3)**, **I(B)(3)**, **I(C)(3)**, and **I(D)(2)** reply to the Examiner's responses to arguments made in the Response of 12/3/2018.

I(A). A person of ordinary skill in the art would not combine Nelson and Felsvang as alleged.

As explained herein at **I(A)(1)**, Br_2 is not HBr and does not include HBr, and Cl_2 is not HCl and does not include HCl; also, Br_2 is not and does not include Br^-, and Cl_2 is not and does not include Cl^-. As explained herein at **I(A)(2)**, there would be no motivation for a person of ordinary skill in the art to use Nelson's HBr in place of Felsvang's HCl or Cl^- in Felsvang's process. Section **I(A)(3)** includes replies to the Examiner's responses to arguments in the Response of 12/3/2018.

I(A)(1). Br_2 is not HBr and does not include HBr, and Cl_2 is not HCl and does not include HCl; also, Br_2 is not and does not include Br^-, and Cl_2 is not and does not include Cl^-.

As explained in Declaration C at item 17, hydrogen halides are diatomic molecules including a halogen atom and a hydrogen atom; in contrast, elemental halogens are diatomic molecules including two of the same halogen atom. HBr and HCl each include a hydrogen atom and one halogen atom, while Br_2 and Cl_2 each include two halogen atoms. Hydrogen halides have different properties than elemental halogens and are therefore different compounds. HBr has a molecular weight of 80.91 g/mol, while Br_2 has a molecular weight of 159.81 g/mol; HBr has a boiling point of -67 °C, while Br_2 has a boiling point of 58.8 °C; HBr has a melting point of -87 °C, while Br_2 has a melting point of -7.2 °C. HCl has a molecular weight of 36.46 g/mol, while Cl_2 has a molecular weight of 70.91 g/mol; HCl has a boiling point of -85 °C, while Cl_2 has a boiling point of 70.91 g/mol; HCl has a melting point of -114 °C, while Cl_2 has a melting point of -101 °C. Hydrogen halides are not part of and cannot be extracted or isolated from elemental halides; rather, only via a chemical reaction that results in a chemical and structural change can hydrogen halides be formed from elemental halides. Hydrogen bromide is produced by reacting hydrogen and Br_2 at about 200-400 °C, a reaction that is typically catalyzed by platinum or asbestos. Hydrogen chloride is produced by reacting hydrogen and chlorine with one another. Therefore, elemental halogens are not hydrogen halides, and do not include hydrogen halides—Br_2 is not HBr and does not include HBr, and Cl_2 is not HCl and does not include HCl.

As explained in Declaration C at item 18, chlorine has an atomic number of 17, meaning it has 17 protons and 17 electrons, giving it an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^5$, having 7 electrons in its outer shell. Bromine has an atomic number of 35, meaning it has 35 protons and 35 electrons, giving it an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$, also having 7 electrons in its outer shell. According to the octet rule, a halogen atom desires to fill its outer shell with 8 electrons total by gaining one electron. A halide ion is a halogen atom that has accepted an electron from an electron doner, in the case of chloride (Cl^-) giving it 18 total electrons to give a total charge of -1, and in the case of bromide (Br^-) giving it 36 total electrons to give a total charge of -1. Halogen atoms do not donate electrons to other atoms, because this would result in a halogen atom losing an electron to have 6 electrons in its outer shell, an unstable configuration according to the octet rule. In the case of an elemental halogen, which exists as a diatomic molecule, instead of

donating electrons to one another, each halogen atom shares one of its electrons in the outer shell with the other halogen atom via overlapping electron orbitals in a covalent bond, allowing each halogen atom to have a filled octet while the diatomic molecule remains neutrally charged. Therefore, a halogen atom does not donate electrons to another halogen atom to form a halide, and a diatomic halogen molecule never includes a halide; Br_2 is not and does not include Br^-, and Cl_2 is not and does not include Cl^-.

I(A)(2). There would be no motivation for a person of ordinary skill in the art to use Nelson's HBr in place of Felsvang's HCl or Cl^- in Felsvang's process.

The Office Action admits that Felsvang fails to describe or suggest a halogen or halide promoter that is Br_2, HBr, or Br^-. Nelson fails to describe or suggest in-flight promotion of activated carbon with a halide or hydrogen halide in the flue gas. The Office Action alleges that one of ordinary skill in the art would replace Felsvang's HCl or Cl^- with Nelson's HBr to accomplish the presently claimed method, stating that such a modification of Felsvang would be made "…to promote activated carbon (Nelson paragraphs [0017] and [0041]) so as to provide an effective carbon sorbent for mercury." (Office Action, page 4, last sentence of second full paragraph). Applicant respectfully disagrees. As explained below, a person of ordinary skill in the art would not be motivated to use Nelson's HBr in Felsvang's process, because Nelson fails to describe or suggest that HBr-treatment of activated carbon provides similar, let alone improved, mercury-removal ability as compared to HCl or Cl^--treatment of activated carbon.

As explained herein at **I(A)(2)(a)**, Felsvang focuses on HCl or Cl^- concentration in the flue gas. As explained herein at **I(A)(2)(b)**, a person of ordinary skill in the art would not combine Nelson with Felsvang as alleged because Felsvang fails to describe or suggest in-flight promotion can occur. As explained herein at **I(A)(2)(c)**, a person of ordinary skill in the art would not be motivated to use Felsvang's process with activated carbon. As explained herein at **II(A)(2)(d)**, Nelson provides no motivation to replace Felsvang's HCl or Cl^- treatment with Nelson's HBr treatment.

I(A)(2)(a). Felsvang focuses on HCl or Cl^- concentration in the flue gas.

Felsvang is directed to adding chlorine (Cl_2) or chloride (Cl^-) materials to the coal or combustion products. Felsvang makes clear that addition of chlorine or chloride material increases the amount of chloride supplied to the flue gas, or to the drying-absorption zone, see, Abstract and col. 3, lines 40-44. Felsvang states at col. 3, line 67 bridging to col. 4, line 4: "[i]t has been experienced that the increase of the Hg-removing effect of chloride addition to the drying-absorption zone in a process treating flue gases of low chloride content is especially remarkable when activated carbon is present...." Felsvang states at col. 4, lines 51-55: "...most chloride or chlorine containing compounds will release gaseous chlorides when introduced into the combustion zone of a coal fired boiler...." Felsvang states at col. 6, lines 3-11:

> **If the chloride content is found to be below a certain value as defined above and in the attached claims arrangements are taken according to the invention for increasing the gas chloride content. This may be done in connection with an introduction of activated carbon which in itself also has a Hg removing effect and together with chloride addition exihibts a synergistic effect enabling an extremely efficient Hg removal.**

At column 3, lines 53-55, Felsvang states that "[t]he term 'chloride' is intended to mean chloride ions as such or gaseous hydrogene chloride or compounds which by heating in the presence of coal forms Cl^- or HCl." Thus, Felsvang gives a definition of "chloride" that includes both HCl and Cl^-.

I(A)(2)(b). A person of ordinary skill in the art would not combine Nelson with Felsvang as alleged because they would not know or expect in-flight promotion of the activated carbon sorbent would occur.

As explained herein at **I(A)(2)(b)(i)**, a person of ordinary skill in the art would not combine Nelson with Felsvang as alleged because Felsvang fails to describe or suggest in-flight promotion can occur. As explained herein at **I(A)(2)(b)(ii)**, promoter concentration in flue gas is low compared to during treatment outside of flue gas. As explained herein at **I(A)(2)(b)(iii)**, contact time between promotors in the flue gas and activated carbon is very short compared to treatment outside the flue

gas. As explained herein at **I(A)(2)(b)(iv)**, a person of ordinary skill in the art would believe that hydrogen halides in the flue gas would be consumed via corrosion or scavenging.

I(A)(2)(b)(i). A person of ordinary skill in the art would not combine Nelson with Felsvang as alleged because Felsvang fails to describe or suggest in-flight promotion can occur.

Felsvang fails to describe or suggest that any reaction occurs between activated carbon and HCl in the flue gas. Felsvang's primary focus is the enhancement of HCl or Cl^- concentration in the flue gas, with addition of activated carbon being optional and not required to experience the effect of the invention. At col. 6, lines 29-33, Felsvang states "...the chloride introduction may alternatively be performed separately from the introduction of activated carbon or it may be performed without using activated carbon." At col. 6, lines 8-11, Felsvang explains that, in addition to increasing the chloride content, (emphasis added) "[t]his may be done in connection with an introduction of activated carbon which in itself also has a Hg removing effect and together with chloride addition exhibits a synergistic effect enabling an extremely efficient Hg removal." Felsvang therefore describes that activated carbon removes mercury, and that increasing HCl or Cl^- content removes mercury, and when the two are used together they operate side-by-side, failing to describe or suggest any reaction that occurs between the HCl or Cl^- and the activated carbon. Only a portion of Felsvang's Example 4 demonstrates the use of activated carbon with HCl or Cl^-, finding only a small increase in mercury-removal activity (discussed herein at **I(A)(2)(c)**), while the majority of Felsvang's Examples (1-3) are devoid of any mention of activated carbon.

In contrast, Nelson describes a chemical reaction that occurs between the halogens and the activated carbon, and disparages simple impregnation or physical adsorption of halogens onto the activated carbon, explaining at paragraphs [0017] and [0044] that physical adsorption leads to desorption from the activated carbon. Nelson explains at paragraphs [0044] and [0053] that elevated temperatures should be used during the treatment of the activated carbon with the bromine gas to minimize physical absorption and maximize chemical reaction between the bromine and the activated carbon which avoids desorption of the bromine during transport, storage, and upon injection into a hot gas stream.

A person of ordinary skill in the art would have to understand that a reaction can occur between Felsvang's HCl or Cl^- and the activated carbon in Felsvang's flue gas in order to

understand that Nelson's bromine-treated sorbents have any similarity to the sorbents of Felsvang. With Felsvang's failure to describe or suggest any chemical reaction between the activated carbon and the HCl or Cl^- in the flue gas, a person of ordinary skill in the art would have no idea that Nelson's hydrogen bromide could be used in place of Felsvang's HCl or Cl^-. Therefore, a person of ordinary skill in the art would not replace Felsvang's HCl or Cl^- with HBr or Br^-. Independent claims 27, 54, and 55 are patentable for at least this reason.

I(A)(2)(b)(ii). Promoter concentration in flue gas is low compared to during treatment outside of flue gas.

At paragraph [0051] Nelson gives a preference for the use of pure Br_2 or HBr to treat the activated carbon. Nelson's Examples do not mention the use of a carrier gas to dilute the halogen gases used to prepare the treated sorbents used therein.

Forming HBr or Br^- in the flue gas from bromide salts such as NaBr on coal gives a very low concentration of HBr/Br^- in the flue gas compared to pure HBr. A person of ordinary skill in the art would believe the concentration of HBr/Br^- in the flue gas would be too low to result in effective treatment of activated carbon injected into the flue gas, especially considering the short contact time between the HBr/Br^- and the activated carbon as discussed herein at **I(A)(2)(b)(iii)**.

I(A)(2)(b)(iii).Contact time between promotors in the flue gas and activated carbon is very short compared to treatment outside the flue gas.

As explained in Declaration A at item 10, Nelson states repeatedly that the bromine-containing gas is to be contacted with the activated sorbent "for a sufficient time" to increase the ability of the activated carbon to adsorb mercury. See, e.g., Abstract and paragraphs [0023] and [0028]. Nelson at page 8, paragraph [0087] and the table at the top of the second column describes contact times required to form HBr- and Br_2-treated activated carbons. For HBr-treated activated carbon, the adsorption rate was 1 gram of HBr absorbed per 1 kg of activated carbon per minute, or 0.1 wt% HBr absorbed per minute, meaning that to reach the 9 wt% HBr reported in the table required about 90 minutes. Note that Figure 14 reports results for 10 wt% HBr, and Figure 15 reports results for 9 wt% HBr. For Br_2-treated activated carbon, the adsorption rate was 10 grams of

Br_2 absorbed per 1 kg of activated carbon per minute, or 1 wt% Br_2 absorbed per minute, meaning that to reach the 15 wt% Br_2 reported in the table required about 15 minutes. Note that Figures 14 and 15 report results for 1.5 wt%, 5 wt%, and 15 wt% Br_2, according to the table requiring about 1.5 to 15 minutes to form. In contrast, as explained in Declaration A at item 10, contact times between a promoter in the flue gas and activated carbon injected therein are generally less than 10 seconds.

As explained in Declaration A at item 8, before the priority date of the present claims, the EPA did not recommend in-flight sorbent enhancement in the flue gas by spraying additives on coal or injecting halogens into the boiler. Rather, it described research into methods for *pre-treating* sorbents with various additives, including chlorine, and then injecting those pre-treated sorbents downstream from the boiler. This approach ensured that the sorbent additive would have plenty of time to react with the sorbent—the EPA explained that, for many plants, injected sorbents would have only a few seconds to find and react with mercury present in the flue gas, with high and costly carbon-to-Hg ratios needed to achieve adequate mercury removal.

A person of ordinary skill in the art would believe the contact time between HBr/Br^- in the flue gas would be too short to increase the ability of the activated carbon injected into the flue gas to adsorb mercury, especially considering the low concentration of HBr/Br^- in the flue gas as discussed herein at **I(A)(2)(b)(ii)**.

I(A)(2)(b)(iv).Consumption of hydrogen halides in the flue gas via corrosion or scavenging.

As explained in Declaration A at item 10, Nelson states at paragraph [0044] that a corrosion-resistant material should line the equipment used to mix the bromine gas and the activated carbon "…because the bromine species can be quite corrosive." Nelson states at paragraph [0051] that "[i]t it not a preferred embodiment of this invention to include water with the bromine gas vapor if this causes corrosion problems in the processing equipment that outweigh any advantages."

As explained in Declaration A at item 8, before the priority date of the presently claimed invention, the EPA did not recommend in-flight sorbent enhancement in the flue gas by spraying additives on coal or injecting halogens into the boiler. Rather, it described research into methods for *pre-treating* sorbents with various additives, including chlorine, and then injecting those pre-treated sorbents downstream from the boiler. This approach ensured that, e.g., chlorinating agents could react with the sorbent material without being "scavenged" by other chemicals present in the boiler.

A person of ordinary skill in the art would believe that HBr in the flue gas would be consumed via corrosion of the combustion chamber and other metallic areas of the coal-combustion plant in contact with the flue gas, or via scavenging by other species present in the flue gas. As a result, a person of ordinary skill in the art would believe that an inadequate concentration of HBr would be present for reaction with activated carbon injected into the flue gas, especially considering the low concentration of HBr/Br^- in the flue gas as discussed herein at **I(A)(2)(b)(ii)**, and the short contact time between the HBr/Br^- and the activated carbon as discussed herein at **I(A)(2)(b)(iii)**.

I(A)(2)(c). A person of ordinary skill in the art would not be motivated to use Felsvang's process with activated carbon.

Felsvang gives no data showing that the addition of HCl or Cl^- additives to coal can produce enhanced HCl or Cl^- concentrations in the activated carbon. Felsvang includes only a single Example showing the use of activated carbon for mercury removal, Example 4, the relevant portions of which are reproduced below (col. 9, lines 21-46):

HCl concentration in the flue gas was 142 mg/Nm^3. Mercury was measured in and out of the system. The following results were achieved:

Inlet µgHg/Nm^3 at 5% O_2	Outlet µgHg/Nm^3 at 5% O_2	% Removal
5.4	0.14	97
5.2	0.18	97
5.0	0.20	96
4.7	0.18	96

Average removal with this system is 96%.

The above process was modified by adding activated carbon through conduit 14 to the stream of flue gas in duct 4 upstream of the drying chamber. Mercury was measured in and out of the system.

The following results were achieved:

Amount of carbon mg/Nm^3	Inlet µgHg/Nm^3 at 5% O_2	Outlet µgHg/Nm^3 at 5% O_2	% Removal
8	4.0	0.10	98
8	4.4	<0.01	>99.8
36	6.2	0.01	99.8
36	5.6	<0.01	>99.7

Felsvang finds in Example 4 that HCl alone provided 96-97% mercury removal, while the addition of activated carbon provided 98-99.8% mercury removal, an improvement of only 1-3.8%. In contrast, Felsvang's Comparative Examples 1-3, performed with no added HCl or Cl^- in the flue gas and no activated carbon, had a mercury removal of 1-37%. The activated carbon in Example 4 provided scarcely any improvement, with the vast majority of mercury removal improvement occurring in the presence of HCl alone without activated carbon. An improvement of 1-3.8% does not demonstrate a synergistic effect between HCl and activated carbon, especially in view of the 60-96% improvement in mercury removal achieved by HCl alone when Example 4 is compared to Comparative Examples 1-3. One of ordinary skill in the art would know that such a small

improvement could have been caused by variability in combustion gas conditions and the accuracy of the measurements—evidence for any improvement from the use of activated carbon with the HCl in Felsvang is very weak and may not have occurred at all.

In addition, Felsvang fails to describe or suggest that in-flight promotion of activated carbon with HCl or Cl^- in the flue gas provides better mercury removal than treatment of activated carbon outside the flue gas with HCl. If one of ordinary skill in the art were hypothetically considering whether to use Felsvang's HCl or Cl^- treatment of activated carbon in the flue gas or Nelson's treatment of activated carbon outside the flue gas to remove mercury, that person would pick the process that results in the best mercury removal. As an initial matter, before considering modifying either one of the references, the person of ordinary skill would notice the extremely poor improvement (if any improvement actually occurred) caused by addition of activated carbon in Felsvang's sole Example showing the use of activated carbon (Example 4) and would question whether Felsvang's process is an efficient way to use activated carbon for mercury removal as compared to Nelson's process. If one of ordinary skill in the art were to investigate Felsvang's embodiments including activated carbon and compare the relative mercury-removal ability to that of activated carbon treated with HCl outside the flue gas, as shown herein at **I(D)**, they would find that treatment of activated carbon outside the flue gas with HCl as per Nelson's process actually provides more effective mercury removal per wt% HCl than treatment of activated carbon with HCl or Cl^- in the flue gas, which would lead one of ordinary skill in the art away from using Felsvang's process in the first place.

Therefore, a person of ordinary skill in the art hypothetically having Felsvang and Nelson in-hand would not select the Felsvang process to follow or modify and therefore would not be motivated to combine Felsvang and Nelson as alleged. Independent claims 27, 54, and 55 are patentable over Felsvang and Nelson for this additional reason.

I(A)(2)(d). Nelson provides no motivation to replace Felsvang's HCl or Cl^- treatment with Nelson's HBr treatment.

For a person of ordinary skill in the art to be motivated to replace Felsvang's HCl- or Cl^--treatment with treatment by another material to provide an effective activated carbon sorbent for mercury removal, that person would need to think that the material they are using to replace the HCl

or Cl^- would result in the same or better mercury-removal efficiency. However, as explained below, Nelson fails to describe or suggest that treatment of activated carbon with HBr provides the same, let alone better, mercury removal efficiency as activated carbon treated with HCl or Cl^-.

At paragraph [0017], Nelson states:

> **[0017]** The particular advantages of using bromine, rather than iodine or iodides, or chlorine or chlorides, with activated carbons for mercury control have not been previously appreciated. Gaseous bromine and hydrogen bromide have been combined with carbon substrates before, but not to sequester mercury from hot combustion-gas streams. For example, Greinke U.S. Pat. No. 5,372,619 found that bromine-treated carbon can make a superior natural-gas storage medium. In another example, SKC Inc. sells a small tube with hydrobromic acid-treated charcoal to sample air for ethylene oxide. However, with both of these uses it is important that the adsorption targets, natural gas and ethylene oxide, be easily desorbable from the carbon, the exact opposite of what is required in a mercury vapor sequestration application. In a similar vein, in U.S. Pat. No. 6,475,461 Ohsaki describes a process for treating carbon substrates with gaseous bromine or chlorine, but then explicitly desorbs them to achieve his desired product. Seki U.S. Pat. No. 3,961,020; Yoshida and Seki et al. U.S. Pat. No. 4,174,373; and Knoblauch et al. U.S. Pat. No. 5,179,058 impregnate activated carbon with bromine to produce a catalyst for reacting nitrogen oxide with ammonia to form nitrogen and water. In this application too, the bromine of the carbon does not act as a sequestration agent, permanently tying up its target. Rather, it serves as a catalyst, taking part in a repeated series of desired chemical reactions, but not becoming permanently consumed by any of them. Perhaps it is understandable that the tenacity of carbon-bromine-mercury complexes could be overlooked.

The first sentence of paragraph [0017] refers to the "…particular advantages of using bromine…" for treatment of activated carbons for mercury control, which must mean either elemental bromine (Br_2) or the element bromine generally, and is not a specific reference to bromides (Br^-). The "…particular advantages of using bromine…" is compared to iodine (I_2),

iodides (I^-), chlorine (Cl_2), and chlorides (Cl^-), but no specific comparison is made between bromides (Br^-) and chlorides (Cl^-). However, it does not make sense for Nelson to refer to the element bromine generally while specifically distinguishing between chlorine (Cl_2) and chlorides (Cl^-), and iodine (I_2) and iodides (I^-) in the same sentence. If Nelson wanted to compare both elemental bromine (Br_2) and hydrogen bromide (HBr) to the other halides specifically disclosed in the first sentence, Nelson would have specifically distinguished between bromine (Br_2) and bromides (Br^-); therefore, "…bromine…" in the first sentence of paragraph [0017] would be interpreted as elemental bromine (Br_2), and not as the element bromine generally.

No "…particular advantages of using bromine…" are explicitly described in paragraph [0017], with the remainder of the paragraph focusing on the failure of the prior art to use bromine with activated carbon for mercury control, describing various disadvantages of other processes, such as the desorbability of Br_2, HBr, or Cl_2 from the activated carbon, or the failure of the Br_2 or HBr to act as a mercury sequestration agent. The paragraph concludes with a statement that it is understandable that "…the tenacity of carbon-bromine-mercury complexes…" could be overlooked, which must refer to complexes including either elemental bromine (Br_2) or the element bromine generally, with no specific reference to bromide (Br^-) or complexes formed therefrom. The concluding statement of paragraph [0017] is directed toward the discussion in the bulk of paragraph [0017]—the prior art fails to use bromine with activated carbon for mercury control and therefore fails to generate carbon-bromine-mercury complexes—rather than as a statement of any relative advantage of bromine over other halogens or halides. The "…tenacity of carbon-bromine-mercury complexes…" is not specifically compared to the strength of any other complexes, such as carbon-chlorine-mercury complexes, carbon-chloride-mercury complexes, carbon-iodine-mercury complexes, or carbon-iodide-mercury complexes; therefore, at best, the "…tenacity…" of the complexes described in the last sentence of paragraph [0017] can be regarded as a general statement, rather than as a comparative one. Paragraph [0017] fails to attribute any advantage of Nelson's invention specifically to HBr or Br^-, and, moreover, fails to describe or suggest that HBr or Br^- treatment of activated carbon could provide equal, let alone better, mercury removal than HCl or Cl^- treatment of the activated carbon.

At paragraphs [0019]-[0022], Nelson states:

> **[0019]** Accordingly, it is an object of the present invention to provide a sorbent material that can be injected into a hot mercury-containing combustion gas, so that a significant portion of the mercury is adsorbed onto the sorbent and removed from the flue gas with the combustion fly ash.
>
> **[0020]** Further, it is an object of the present invention to provide a flexible, retrofitable mercury-control method that can be applied to a number of combustion gas streams and a wide range of exhaust system equipment configurations.
>
> **[0021]** In addition, it is an object of the present invention to provide a mercury sorbent material that is simple and inexpensive to manufacture and use.
>
> **[0022]** It is also an object of the present invention to provide a mercury sorbent material that causes the adsorbed gas-phase mercury to become essentially permanently-sequestered from future interactions with the environment.

Paragraphs [0019]-[0022] describe several general advantages of Nelson's activated carbon treatment, including the ability to remove mercury from a hot mercury-containing combustion gas, a flexible and retrofittable method that can be applied to a wide range of equipment configurations, simplicity and ease of use, and permanent sequestration of the mercury from environmental interactions. None of the advantages include equal or greater mercury-removal ability of HBr- or Br'-treated activated carbon as compared to HCl- or Cl'-treated activated carbon.

At paragraphs [0023]-[0024], similarly to what is stated in the Abstract and paragraphs [0028]-[0029], Nelson states:

> The mercury sorbent is prepared by treating a carbonaceous substrate with an effective amount of a bromine-containing gas for a sufficient time to increase the ability of the carbonaceous substrate to adsorb mercury and mercury-containing compounds.
>
> **[0024]** In some aspects of the invention, the bromine-containing gas comprises at least one of: elemental bromine and hydrogen bromide. In some aspects of the invention, the carbonaceous substrate comprises activated carbon.

Nelson therefore states that elemental bromine (Br_2) or hydrogen bromide (HBr) can be used to treat an activated carbon outside of a flue gas to increase the ability of the activated carbon to absorb mercury.

At paragraph [0041], Nelson states:

> **[0041]** I have discovered that the simple act of exposing a carbonaceous material, preferably powdered activated carbon (PAC), to gaseous bromine, $Br_2(g)$, or to gaseous hydrogen bromide, HBr(g), significantly increases the carbonaceous material's ability to remove mercury species when injected into high-temperature coal-fired flue-gas compositions. Surprisingly, gaseous bromine produces a much more effective and appropriate carbon sorbent for mercury in hot combustion gases than do iodine or iodide species, or chlorine or chloride species, in contrast to what has been taught in the prior art.

Paragraph [0041] begins by stating that gaseous bromine (defined as Br_2) or hydrogen bromide (HBr) increases the mercury absorption capacity of activated carbon. Then, paragraph [0041] goes on to explicitly state that gaseous bromine, defined as Br_2 in the prior sentence, produces a more effective mercury-absorbing carbon sorbent than iodine (I_2), iodide (I^-), chlorine (Cl_2), or chloride (Cl^-). With the precise definitions given for gaseous bromine and hydrogen bromide, and then reference only to gaseous bromine in the next sentence, Nelson makes clear that the comparison of efficacy is only with respect to elemental bromine (Br_2) and not hydrogen bromide. Like paragraph [0017], paragraph [0041] also fails to describe or suggest that hydrogen bromide treatment of activated carbons is more effective for mercury removal than HCl or Cl^- treatment of activated carbons.

At paragraph [0042], Nelson states:

> **[0042]** The combination of carbon and gaseous bromine produces an inexpensive sorbent material that can be simply injected into the ductwork of a power plant ahead of an existing electrostatic precipitator, without the need for large volumes of sorbent, retrofitted flue-gas cooling, or extended sorption time on an additional fabric filter.

Paragraph [0042]'s reference to "gaseous bromine" refers only to elemental bromine (Br_2) due to the explicit definition given in the preceding paragraph [0041]. Paragraph [0042] expands on the advantage mentioned at paragraphs [0020]-[0021], stating that an advantage of the invention includes simple injection of the treated activated carbon sorbent into the ductwork ahead of an ESP, without the need for large volumes of sorbent, retrofitted flue-gas cooling, or extended sorption time on a filter.

At paragraph [0043], Nelson states:

> **[0043]** While not intending to be limited by hypothesized chemistry, it appears that in exposing PAC to concentrated bromine gas, a relatively large quantity of the bromine reacts with the carbon, forming surface compounds on the large surface-area of the carbon. When the PAC is then injected into the flue gas, the elemental mercury and oxidized mercury species there appear to react with at least one form of the bromine-carbon surface compounds that were created and are held fast. When the carbon particles are removed from the flue gas along with the fly ash by the electrostatic precipitator (ESP) or fabric filter, the mercury is removed with them. The mercury sorbents are then disposed of with the fly ash. Because the mercury has been chemically adsorbed, rather than just physically adsorbed, the captured mercury appears to be very stable and does not revolatilize or leach.

Paragraph [0043] expands on the general advantage described in paragraph [0022] of permanent sequestration of the mercury from environmental interactions. The advantage is not described or suggested to include equal or greater mercury-removal ability of HBr- or Br^--treated activated carbon as compared to HCl- or Cl^--treated activated carbon.

At paragraph [0044], Nelson states:

> **[0044]** Production of the new mercury sorbent materials is simple and inexpensive. The carbon material and the bromine gas need simply be contacted with each other for the advantageous mercury-reactive surface compounds to quickly form. Elemental bromine is a liquid at ambient temperature, but turns to a gas at only a modestly elevated temperature. Hydrogen bromide is a gas at even ambient temperature. Using a gas-phase carbon reactant considerably simplifies the production of the sorbent and leads to the low costs which are a requirement for a sorbent to be used as a once-through duct injectant. Any common mixing method and equipment can be use to contact the gaseous bromine species with the carbon-based substrates, although it is preferably lined with corrosion-resistant material, because the bromine species can be quite corrosive. It is also preferable that the mixing of bromine gas and carbon be done at an elevated temperature. This keeps the bromine gas in the gaseous form, but also minimizes the amount of any bromine physically-adsorbed into the pores of the carbon. Such physically adsorbed bromine is not chemically bound to the carbon lattice and can be emitted in handling, in storage, and especially, when the sorbent is injected into a hot flue gas.

Paragraph [0044] expands on the general advantage described in paragraph [0021] of simple and inexpensive generation and use of the treated activated carbon sorbent. Paragraph [0044] also describes that elevated temperature during treatment can provide an advantage of reduced physical-adsorption of the elemental bromine or the hydrogen bromide, which helps to avoid emission during handling, storage, and during injection into a hot flue gas. The advantages are not described or suggested to include equal or greater mercury-removal ability of HBr- or Br^--treated activated carbon as compared to HCl- or Cl^--treated activated carbon.

At paragraph [0047], Nelson states:

> the process. An example would be a powdered activated carbon (PAC). Such a material would already have some gas-phase mercury adsorption capability which the treatment process of this invention will greatly amplify.

Nelson therefore states that the treatment process therein amplifies the mercury absorption capabilities of activated carbon. The advantage is not described or suggested to include equal or

greater mercury-removal ability of HBr- or Br^--treated activated carbon as compared to HCl- or Cl^--treated activated carbon.

At paragraph [0049], Nelson states:

> **[0049]** A critical element in the process is that a bromine-containing gas 3 is used to treat the carbonaceous substrate. Preferably this gas comprises elemental bromine, $Br_2(g)$, although other bromine-containing gases, such as hydrogen bromide, HBr, will also have the advantageous effect of the invention.

Nelson therefore states that elemental bromine (Br_2) or hydrogen bromide (HBr) gas can be used to treat an activated carbon outside of a flue gas. Nelson also states that use HBr to treat the activated carbon "…will also have the advantageous effect of the invention." Nelson uses the singular "…effect…" and does not state that HBr can have all of the advantageous effects of Br_2 described therein; however, which particular advantageous effect does Nelson refer to? Further, Nelson refers generally to the advantageous effect of "…the advantageous effect of the invention…" but does not state that HBr can have all the advantageous effects of elemental bromine (Br_2); rather, Nelson states that HBr, like Br_2, can have "…the advantageous effect of the invention." By "…advantageous effect of the invention…" Nelson refers to general advantages of "…the invention…" and not specifically to advantages of Br_2; therefore, advantages specifically attributed to Br_2 in Nelson would not be imputed to HBr by the last sentence of paragraph [0049].

Nelson describes several general advantages at paragraph [0019]-[0022] that are not attributed specifically to Br_2 and that could be referred to by paragraph [0049]'s general reference to "…the advantageous effect of the invention…", such as the ability to remove mercury from a hot mercury-containing combustion gas (expanded on at paragraph [0047]), a flexible and retrofittable method that can be applied to a wide range of equipment configurations (expanded on at paragraph [0042]), simplicity and ease of use (expanded on at paragraphs [0042] and [0044]), and permanent sequestration of the mercury from environmental interactions (expanded on at paragraph [0043]). Paragraphs [0044] and [0053] also describe that elevated temperature during treatment can provide an advantage of reduced physical-adsorption of the elemental bromine or the hydrogen bromide, which helps to avoid emission during handling, storage, and during injection into a hot flue gas. Paragraph [0062] states that mercury sorbents prepared according to Nelson's invention can capture

mercury in at least the lower range of 300 °C to 400 °C. Paragraph [0065] states that injection of the treated activated carbon prior to a fabric filter can provide a longer residence time of the sorbent, higher utilization levels, as well as the possibility of recovering and reinjecting the sorbent at lower costs.

Paragraph [0017] refers to the "…particular advantages of using bromine, rather than iodine or iodides, or chlorine or chlorides, with activated carbon…" but, as explained herein, "…bromine…" would be interpreted as elemental bromine (Br_2); moreover, paragraph [0017] fails to describe or suggest any "…particular advantages of using bromine…." Paragraph [0017]'s concluding statement referring to the "…tenacity of carbon-bromine-mercury complexes…" fails to compare the strength of such complexes to the strength of any other complexes, such as carbon-chlorine-mercury complexes, carbon-chloride-mercury complexes, carbon-iodine-mercury complexes, or carbon-iodide-mercury complexes; therefore, at best, the "…tenacity…" of the complexes described in the last sentence of paragraph [0017] can be regarded as a general statement, rather than as a comparative one.

Paragraph [0041] begins by stating that gaseous bromine (defined as Br_2) or hydrogen bromide (defined as HBr) increases the mercury absorption capacity of activated carbon. Then, paragraph [0041] goes on to explicitly state that gaseous bromine, defined as Br_2 in the prior sentence, produces a more effective mercury-absorbing carbon sorbent than iodine (I_2), iodide (I^-), chlorine (Cl_2), or chloride (Cl^-). With the precise definitions given for gaseous bromine (Br_2) and hydrogen bromide, and then reference only to gaseous bromine (Br_2) in the next sentence, Nelson makes clear that the comparison of efficacy is only with respect to elemental bromine (Br_2) and not hydrogen bromide. Paragraph [0041] fails to describe a general advantage of Nelson's invention, instead, paragraph [0041] specifically and particularly describes an advantage of elemental bromine (Br_2), which cannot be regarded as a general advantageous effect of "…the invention…" as it only applies to elemental bromine (Br_2). Accordingly, advantages explicitly attributed to Br_2 in paragraph [0041] of Nelson cannot be imputed to HBr by the last sentence of paragraph [0049].

Therefore, paragraph [0049] fails to describe or suggest that hydrogen bromide treatment of activated carbons is more effective for mercury removal than HCl or Cl^- treatment of activated carbons.

At paragraph [0050], Nelson states:

> **[0050]** In the liquid form at ambient temperatures, elemental bromine is dense and compact, with advantages in transport and storage. To be utilized in this invention, however, it must first be heated to at least about 60° C. and turned into a gaseous state. In such a state it can more uniformly treat the carbonaceous materials at low levels and provide the desired effect of increasing their mercury sequestration capabilities. A preferred method of converting the liquid bromine to a bromine-containing gas is to use a heated lance. Liquid bromine can be metered into such a heated-lance system at one end and be distributed as a gas to the substrate materials at the other end.

Nelson therefore states that an advantage of elemental bromine (Br_2) is that it is dense and compact which provides advantages in transport and storage.

At paragraph [0051], Nelson states:

> **[0051]** In some applications it may be beneficial to utilize a diluting carrier gas to better distribute the $Br_2(g)$ or HBr(g) among the carbonaceous substrate particles. However, if the process of this invention is practiced in a batch mode, it can be preferable to use pure $Br_2(g)$ or HBr(g). These can be

Nelson therefore states that elemental bromine (Br_2) or hydrogen bromide can be dispersed in a carrier gas during the treatment of the activated carbon.

At paragraph [0053], Nelson states:

> reactive towards mercury. By exposing the carbon to the bromine at an elevated temperature, less of the bromine species will volatilize off from the sorbents during their transport and storage or upon their injection into the hot combustion stream.

Paragraph [0053] describes that elevated temperature during treatment can provide an advantage of reduced volatilization during transport, storage, or during injection into the hot flue gas, expanding on the advantage described at paragraph [0044].

At paragraph [0054], Nelson states:

> **[0054]** Any level of bromination of carbonaceous substrates appears to increase their mercury-removal performance. While over 30 wt % of $Br_2(g)$ can be adsorbed into some powdered activated carbons, for example, significant increases in mercury reactivity will be observed with only about 1 wt % $Br_2(g)$ in the PAC. Greater degrees of bromination do correlate with greater maximum mercury capacities for a particular carbonaceous substrate. However, with the sorbent-injection application of this invention, only a fraction of a material's maximum possible mercury capacity is typically utilized, so the optimum level of bromine to combine with the carbon substrate may vary with the particular situation. If a PAC substrate is used, brominating to 1 wt % provides a highly-capable mercury sorbent, although a 5 wt % material performs better and may be preferable. Brominating to 15 wt % Br_2 generally produces an even more capable mercury sorbent, but as some of the bromine is held at less-energetic sites, there is a greater possibility that some degree of bromine may evolve off under some circumstances. Mercury sorbents with higher bromine concentrations will take longer to produce and cost more as well.

Paragraph [0054] refers to bromination of activated carbon, referring only to specific amounts of Br_2 used to treat the activated carbon and not giving any reference to, let alone specific amounts of, hydrogen bromide.

At paragraph [0062], Nelson states:

> **[0062]** **FIG. 4** describes the possible application of the sorbents to a plant which has a "hot-side" ESP, a particularly difficult situation for mercury control. In this equipment arrangement, the air preheater **22** follows the ESP **32**, so the temperature of the mercury-containing flue gas in the ductwork **64** before the particulate collection is very high, in the range of 300-to-400° C. Plain powdered activated carbons do not capture any mercury at these temperatures and PACs impregnated with iodine or sulfur lose their impregnates. Surprisingly, the mercury sorbents prepared according to the process of this invention appear to capture mercury in at

> least the lower end of this temperature range. Consequently, the sorbents from bin **71** can be useful even when injected at **72** into the very hot, low-oxygen, mercury-containing gases in ductwork **64**. The sorbents would be collected with the other gas stream particulates in the hot-side ESP **32** and the cleaned gas would proceed through ductwork **65** to the smokestack.

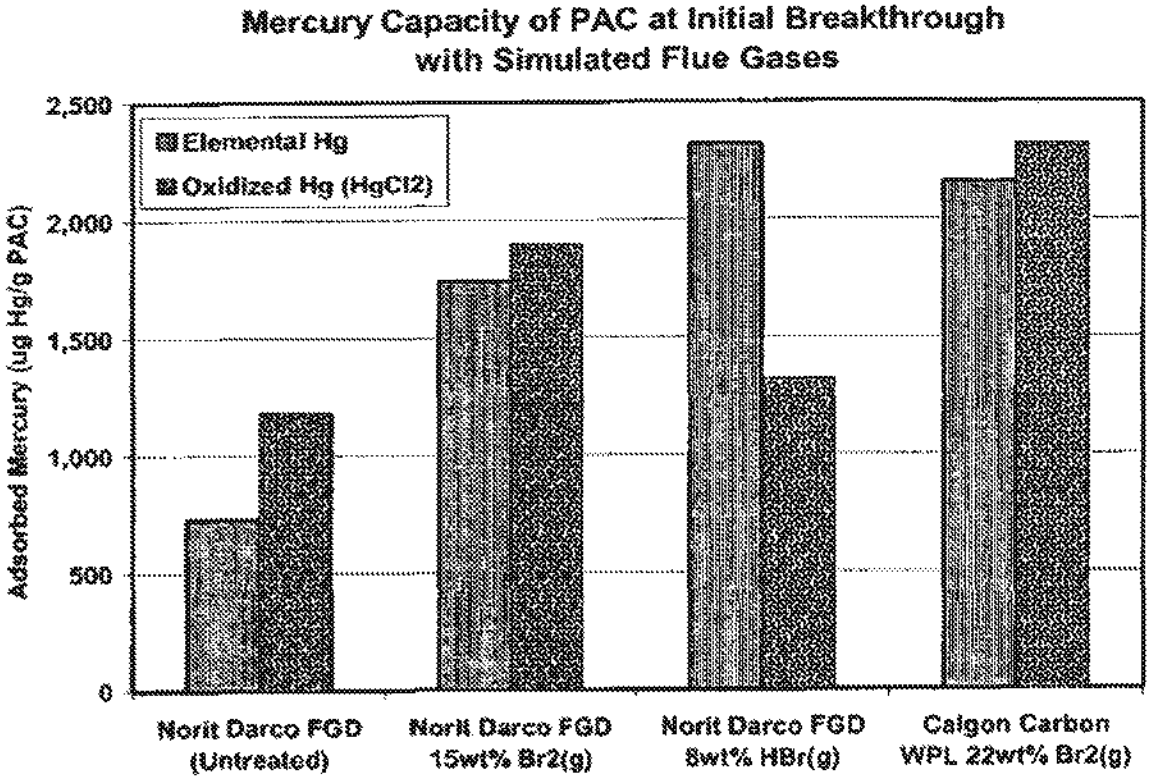
Paragraph [0062] states that mercury sorbents prepared according to Nelson's invention can capture mercury in at least the lower range of 300 °C to 400 °C, unlike activated carbons impregnated with iodine or sulfur.

At paragraph [0065], Nelson states:

> **[0065]** Two such arrangements bear particular mention. **FIG. 5** applies the sorbents in a "TOXECON®" arrangement. Here the mercury sorbents **71** are injected after an ESP **32** into the almost particulate-free ductwork **67** before a small, high-velocity fabric filter **33**. In this manner the fly ash **80** does not become mixed with the carbonaceous sorbents, allowing the fly ash to be sold for concrete use. Moreover, the filter cake of fabric filter **33** would predominantly be mercury sorbent, allowing a longer residence time, higher utilization levels, and the possibility of recovering and reinjecting the sorbent to lower costs. The superior reactivity and capacities of the mercury sorbents of this invention make them prime candidates for use in such an arrangement.

Paragraph [0065] states that injection of the treated activated carbon prior to a fabric filter can provide a longer residence time of the sorbent, higher utilization levels, as well as the possibility of recovering and reinjecting the sorbent at lower costs.

Figure 12 of Nelson is reproduced below.



Paragraph [0080], discussing figure 12, states that:

> ...the brominated carbons adsorbed considerably more mercury species than the untreated version, with the improvements averaging about 100%. Importantly, the bromine-gas-treated sorbents removed about as much oxidized mercury-chloride from the test gases as elemental mercury, indicating performance improvements with both kinds of common flue-gas mercury species.

Both of the Br_2-treated activated carbons in figure 12 showed increased removal of both elemental mercury and oxidized mercury as compared to the untreated activated carbon. However, the HBr-treated activated carbon in figure 12 had hardly any improvement in removal of oxidized Hg compared to the untreated activated carbon, which paragraph [0080] describes as one of two common flue-gas mercury species, and that the removal of both of these species is "important."

The majority of Nelson's Examples (1-4 and 8) focus only on Br_2. Nelson's Examples 5-7 demonstrate the use of HBr-treated sorbent; however, none of these Examples or any other parts of Nelson compare the mercury-absorption performance of HBr-treated activated carbon to HCl-treated activated carbon. Although figures 14 and 15 illustrate HBr-treated activated carbon and

Cl_2-treated activated carbon, Cl_2-treated activated carbon is not HCl-treated or Cl^--treated carbon and these figures fail to show any comparison to HCl- or Cl^--treated activated carbon.

At paragraph [0085], Nelson states:

> sorbents of this invention. See **FIG. 14.** About three times as much chlorine-gas treated PAC was required to achieve the same degree of mercury removal as with bromine. The

Figure 14 of Nelson is reproduced below:

Figure 14.

Duct-Injection Pilot Plant with ESP

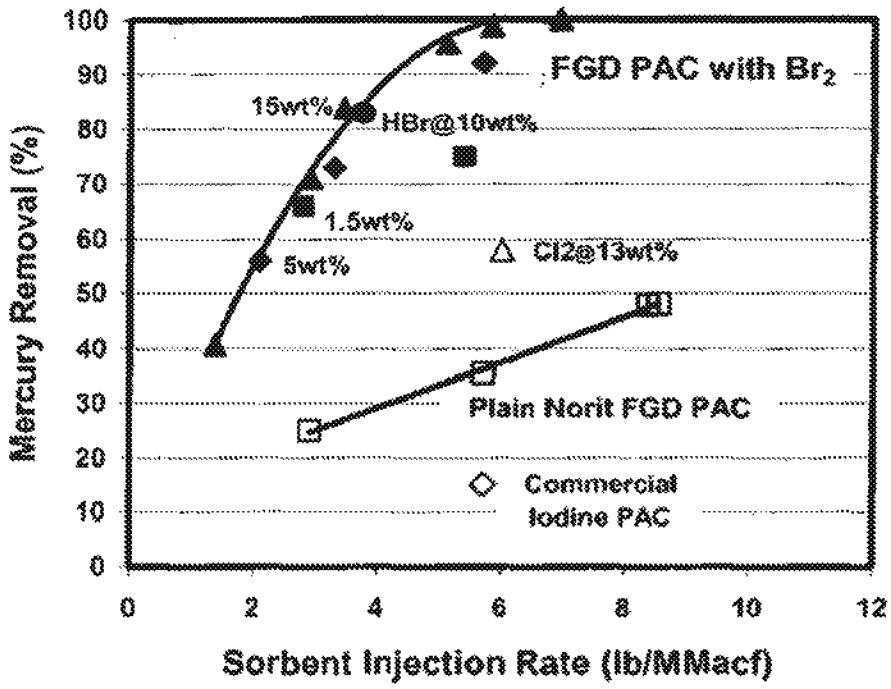


Figure 14 shows mercury removal percent from seven different types of activated carbons: commercial iodine activated carbon, plain Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 10 wt% HBr-treated activated carbon, 1.5 wt% Br_2-treated activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 14 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon). Paragraph [0085] states that about three times as much chlorine-gas treated activated carbon was required to achieve the same degree of mercury removal as with bromine, which can only be a comparison between the 13 wt% Cl_2-treated

activated carbon and the 5 wt% Br_2-treated activated carbon which had a percent mercury removal that was about the same. Further, with regard to figure 14, Nelson states at paragraph [0084] that "[t]here was not much difference in performance between the various brominated samples, probably because in the duct-injection mode they only used a small fraction of their available mercury-adsorption capacity." Therefore, Nelson states that figure 14 does not provide an accurate comparison between the brominated samples, because the full mercury-adsorption capacity was not utilized.

At paragraph [0087], and the following table, Nelson states:

> **[0087]** Manufacture of the elemental bromine sorbents was much faster than for the others. The elemental bromine was adsorbed and reacted with the PACs much faster than was the elemental chlorine, for example—one-hundred-times faster. This allowed for quick and inexpensive manufacture of these sorbents. See the table below with rate data in terms of grams of gas adsorbed per kilogram of PAC per minute. The PAC adsorption of gaseous hydrogen bromide, HBr(g), was ten times faster than it was for chlorine.

Gaseous Halogen	Final Loading on FGD PAC (wt %)	Adsorption Rate (gm of gas) (kg PAC = min)	Concentration in Storage Vessel (ppm)
Br_2 (g)	5%	10	0
Br_2 (g)	15%	10	0.5
HBr (g)	9%	1	N.A.
Cl_2 (g)	13%	0.1	>40

Paragraph [0087] states that the activated carbon adsorbed elemental bromine (Br_2) and hydrogen bromide (HBr) faster than chlorine (explicitly shown as Cl_2 in the Table). The table shows the amount of treatment material (Br_2, HBr, or Cl_2) absorbed on the activated carbon and the rate of adsorption of the treatment material on the activated carbon. Paragraph [0087] and the table that follows make no statements describing or suggesting mercury removal rates of the treated activated carbon.

Figure 15 of Nelson is reproduced below:

Figure 15.

Lausche Plant Duct-Injection ESP Trials

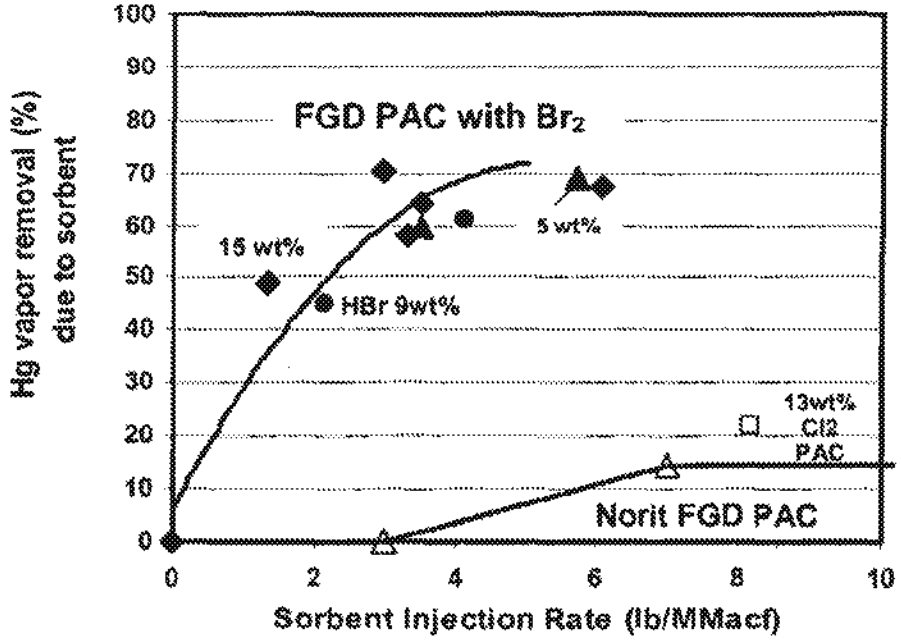


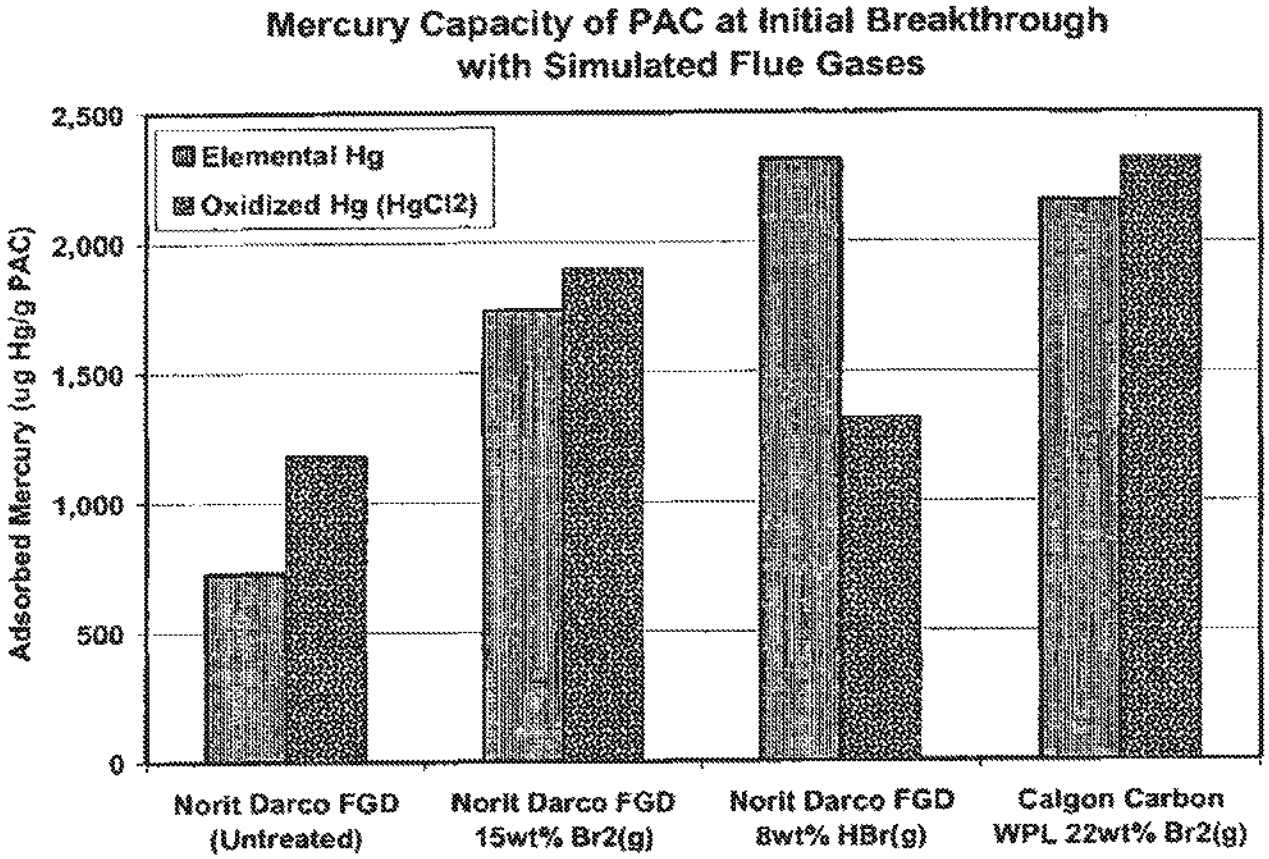
Figure 15 shows mercury removal percent from five different types of activated carbons: Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 9 wt% HBr-treated activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 15 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon). For all data points showing HBr-treated activated carbon, a higher sorbent injection rate was needed to achieve equivalent mercury-removal performance as the Br_2-treated activated carbons (i.e., the HBr data points for a given mercury-removal percentage are always to the right of the Br_2 data points for that mercury-removal percentage), indicating HBr-treated activated carbon to have less mercury-removal ability than Br_2-treated activated carbons.

At paragraph [0092], Nelson states:

> **[0092]** The brominated sorbents of this invention, on the other hand, performed very well with this difficult flue gas, achieving about 50% mercury removal with only 2 lb/MMacf of sorbent consumption and almost 70% removal at an injection rate of 4 lb/MMacf. PACs brominated with Br_2 to 5 wt % and 15 wt %, and with HBr to 9 wt % all performed similarly.

Paragraph [0092] refers to the data shown in Figure 15. However, Figure 15 shows mercury removal percent from five different types of activated carbons: Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 9 wt% HBr-treated activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 15 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon).

Taken in the context of the entire document, figures 14-15 and paragraph [0092] fails to describe or suggest equivalent mercury-removal performance of HBr-treated activated carbon and Br_2-treated activated carbon. With regard to figure 14, Nelson states at paragraph [0084] that "[t]here was not much difference in performance between the various brominated samples, probably because in the duct-injection mode they only used a small fraction of their available mercury-adsorption capacity." Therefore, Nelson states that figure 14 does not provide an accurate comparison between the brominated samples, because the full mercury-adsorption capacity was not utilized. In figure 15, for all data points showing HBr-treated activated carbon, a higher sorbent injection rate was needed to achieve equivalent mercury-removal performance as the Br_2-treated activated carbons (i.e., the HBr data points for a given mercury-removal percentage are always to the right of the Br_2 data points for that mercury-removal percentage), indicating HBr-treated activated carbon to have less mercury-removal ability than Br_2-treated activated carbons. In figure 12, reproduced below, Nelson compares the mercury capacity of untreated activated carbon, 15 wt% Br_2-treated activated carbon, 8 wt% HBr-treated activated carbon, and 22 wt%Br_2-treated activated carbon.



Paragraph [0080], discussing figure 12, states that:

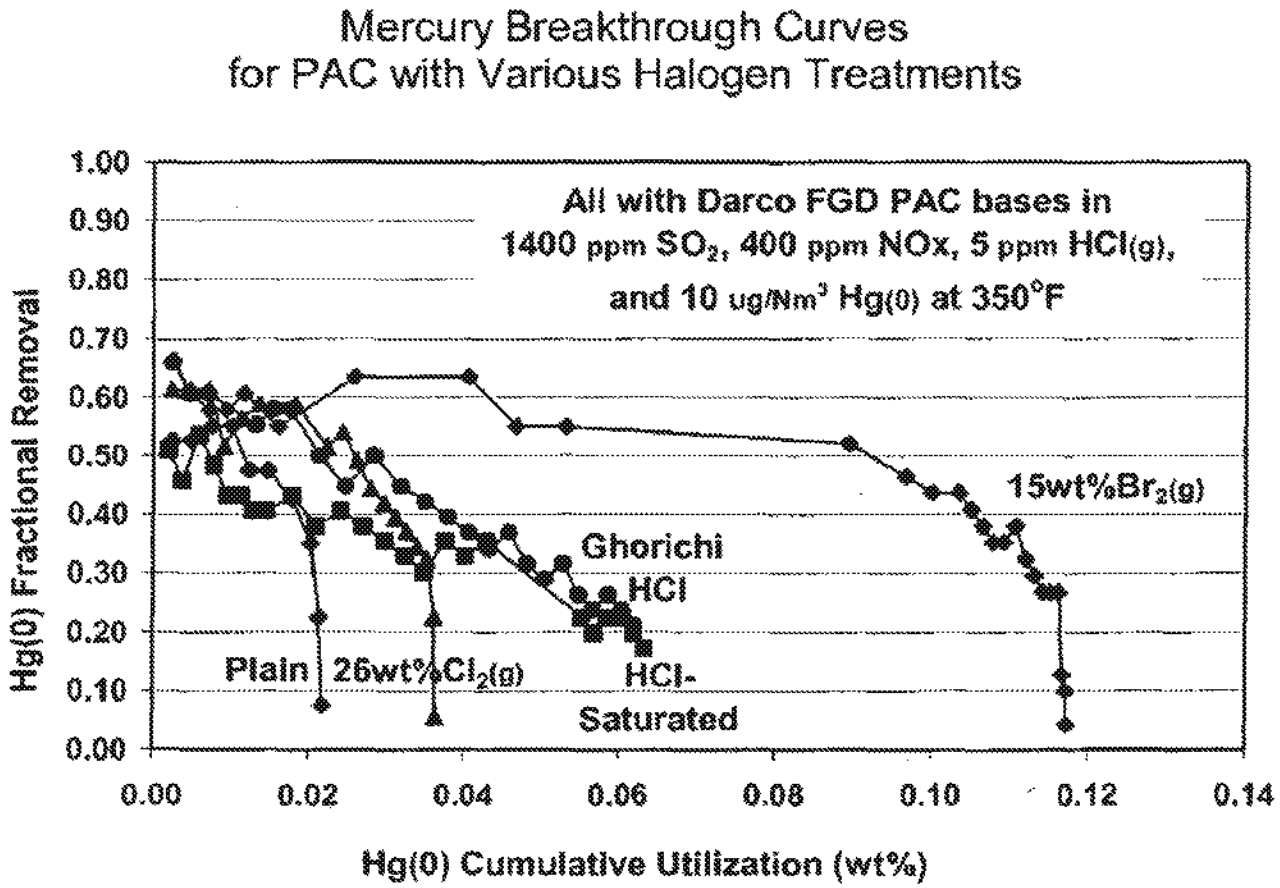
> ...the brominated carbons adsorbed considerably more mercury species than the untreated version, with the improvements averaging about 100%. Importantly, the bromine-gas-treated sorbents removed about as much oxidized mercury-chloride from the test gases as elemental mercury, indicating performance improvements with both kinds of common flue-gas mercury species.

Both of the Br_2-treated activated carbons in figure 12 showed increased removal of both elemental mercury and oxidized mercury as compared to the untreated activated carbon. However, the HBr-treated activated carbon in figure 12 had hardly any improvement in removal of oxidized Hg compared to the untreated activated carbon, which paragraph [0080] describes as one of two common flue-gas mercury species, and that the removal of both of these species is "important."

Nelson does not portray the mercury removal abilities of activated carbon treated with Cl_2 outside the flue gas as equivalent to that of activated carbon treated with HCl outside the flue gas.

At figure 11, reproduced below, Nelson shows mercury breakthrough curves for elemental mercury removal from a non-flue gas "mercury-challenge gas" for powdered activated carbon with various halogen treatments performed outside the flue gas.

Figure 11.



At paragraph [0077], reproduced below, Nelson discusses figure 11.

> **[0077]** The sample that had been exposed to gaseous chlorine, $Cl_2(g)$, exhibited some improvement in mercury removal performance relative to the plain, untreated PAC. Two samples of HCl-treated PACs showed even higher ultimate mercury capacities, but poorer kinetics. One of these samples had been pretreated by flowing gas-phase HCl through the PAC sample until it no longer added mass. The other, acquired from Ghorishi et al., was produced by a dilute liquid-phase HCl treatment described in their publications. The elemental mercury breakthrough curves of the two HCl-treated PACs were very similar, exhibiting a slow and steady drop-off in performance, indicative of poor mercury adsorption kinetics. In contrast, the brominated sample of this invention broke through very sharply and captured more than five times the elemental mercury of the untreated PAC.

At paragraph [0077], Nelson states that the HCl-treated powdered activated carbons had higher capacities for elemental mercury, but showed poorer kinetics. Although some information about how the Cl_2- and HCl-treated activated carbons would behave in a flue gas can be learned from figure 11, a flue gas contains additional species that were not present in the "mercury challenge gas", and, further, can include other forms of mercury other than the elemental mercury measured by the breakthrough test of figure 11, such as oxidized mercury. Nelson does not perform mercury-removal testing of HCl-treated activated carbons in a flue gas. However, Nelson in figure 11, paragraph [0077], and paragraph [0012] refers to HCl-treated activated carbon from Ghorishi et al., which had about the same performance in figure 11 as the HCl-saturated activated carbon prepared by Nelson. At paragraph [0012] Nelson describes a publication by this author, Ghorishi, S.B., Keeney, R.M., Jozewicz, W.S., Serre, S.D. and Gullett, B.K., 2001, In-flight capture of elemental mercury by a chlorine-impregnated activated carbon, Annual Air and Waste Management Association(AWMA) Conference, Orlando, FL, Vol. 24, No. 28 ("Ghorishi").

Ghorishi's conclusion at page 11 states that over 80% mercury removal was accomplished from a flue gas using activated carbon treated outside the flue gas with HCl. Comparing these results to Nelson's results shown in figures 14 and 15, 80% mercury removal is better than the about 58% removal by Cl_2-treated activated carbon in figure 14, is better than the about 22% removal by Cl_2-treated activated carbon in figure 15, and is better than the maximum mercury removal of HBr-

or Br_2-treated activated carbons in figure 15. Therefore, one of ordinary skill in the art hypothetically reviewing Nelson would not only conclude that activated carbon treated outside the flue gas with HCl not only has higher capacity for elemental mercury than Cl_2-treated activated carbon as shown in Nelson's figure 11, but also from comparing Ghorishi to Nelson that activated carbon treated outside the flue gas with HCl has better mercury removal performance in flue gas than Cl_2-treated activated carbon. Accordingly, even if, merely for the sake of argument, one of ordinary skill in the art were to conclude from Nelson's statements at paragraph [0092] that activated carbon treated with HBr or Br_2 outside the flue gas have similar mercury removal abilities, this would not lead to the conclusion that activated carbon treated with HBr outside the flue gas has better mercury removal abilities than activated carbon treated with HCl outside the flue gas.

Nelson never directly compares the mercury-removal ability of HBr-treated activated carbon with HCl-treated activated carbon. With Nelson clearly indicating that HBr-treated activated carbon has inferior mercury-removal ability as compared to Br_2-treated activated carbon, and that HCl-treated activated carbon has superior mercury-removal ability as compared to Cl_2-treated activated carbon, there is no way that one of ordinary skill in the art hypothetically considering Nelson could conclude that HBr-treated activated carbon has equivalent or superior mercury-removal ability compared to HCl-treated activated carbon.

No part of Nelson describes or suggests that HBr or Br^- even have the same effectiveness for mercury sequestration when used to treat activated carbons as HCl or Cl^-, let alone that HBr or Br^- are more effective for mercury sequestration when used to treat activated carbons than HCl or Cl^-. A person of ordinary skill in the art would have no reason to modify Felsvang's HCl or Cl^- process with a different promoter to form an effective carbon sorbent for mercury removal if the resulting mercury-removal efficiency could not be reasonably predicted to be the same or greater as that of Felsvang's original process. Therefore, a person of ordinary skill in the art would not be motivated to replace Felsvang's HCl or Cl^- treatment of activated carbon with Nelson's HBr treatment. Independent claims 27, 54, and 55 are patentable for at least this reason.

I(A)(3). Reply to Examiner's response to arguments.

The Office Action states:

> II A. The applicant traverses the combination of Felsvang and Nelson combination stating that there is no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process. The applicant contends that one having ordinary skill in the art would not be motivated to replace Felsvang's chloride-treatment with treatment by another material as the prior art does not disclose the bromide additives performing the same or better mercury-removal efficiency.
>
> The examiner disagrees. See Fig. 14 of Nelson which shows that about 3 times the amount of chlorine treated PAC was required to achieve the same degree of mercury removal as with bromine, (paragraph [0085]). Also see the absorption rate in the table on page 8. Further as the rejection above states, Both chlorine and bromine are known within the art to treat activated carbon and therefore it would be well within the capability of one having ordinary skill in the art to *either replace the Cl with or include in addition to* the halogen or halide promoter comprising HBr, Br^-, or a combination thereof to promote activated carbon (Nelson paragraphs [0017] and [0041]) so as to provide an effective carbon sorbent for mercury.

The Office Action states that Fig. 14 of Nelson shows that about 3 times the amount of chlorine treated PAC was required to achieve the same degree of mercury removal as with bromine, citing to paragraph [0085]. The Office Action also cites to the absorption rate in the table on page 8.

Although figures 14 and 15 illustrate HBr-treated activated carbon and Cl_2-treated activated carbon, Cl_2-treated activated carbon is not HCl- or Cl^--treated carbon and these figures fail to show any comparison to HCl- or Cl^--treated activated carbon.

At paragraph [0085], Nelson states:

> sorbents of this invention. See **FIG. 14.** About three times as much chlorine-gas treated PAC was required to achieve the same degree of mercury removal as with bromine. The

Figure 14 of Nelson is reproduced below:

Figure 14.

Duct-Injection Pilot Plant with ESP

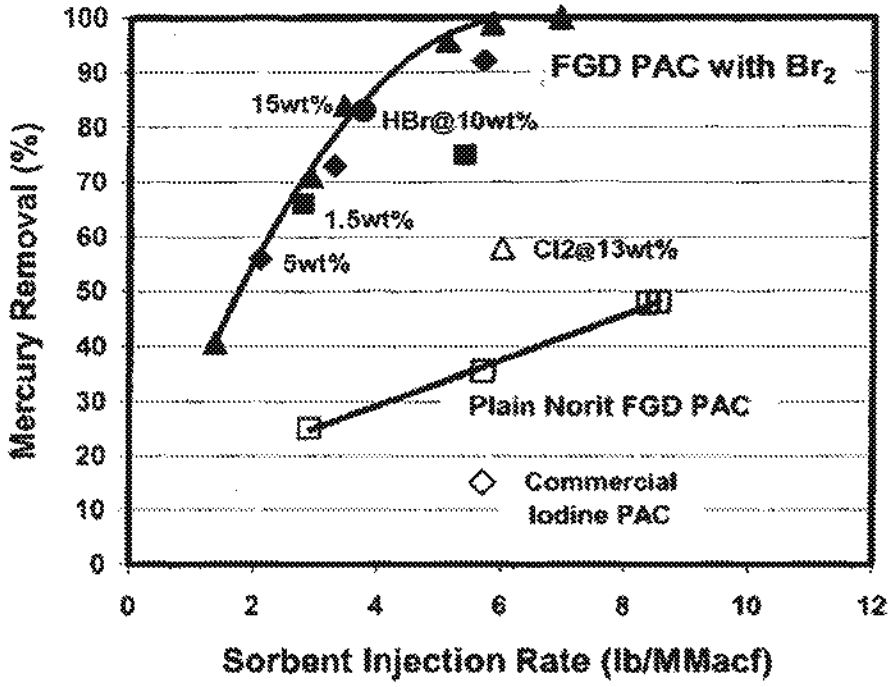


Figure 14 shows mercury removal percent from seven different types of activated carbons: commercial iodine activated carbon, plain Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 10 wt% HBr-treated activated carbon, 1.5 wt% Br_2-treated activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 14 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon). Paragraph [0085] states that about three times as much chlorine-gas treated activated carbon was required to achieve the same degree of mercury removal as with bromine, which can only be a comparison between the 13 wt% Cl_2-treated activated carbon and the 5 wt% Br_2-treated activated carbon which had a percent mercury removal that was about the same.

At paragraph [0017], Nelson states:

> **[0017]** The particular advantages of using bromine, rather than iodine or iodides, or chlorine or chlorides, with activated carbons for mercury control have not been previously appreciated. Gaseous bromine and hydrogen bromide have been combined with carbon substrates before, but not to sequester mercury from hot combustion-gas streams. For example, Greinke U.S. Pat. No. 5,372,619 found that bromine-treated carbon can make a superior natural-gas storage medium. In another example, SKC Inc. sells a small tube with hydrobromic acid-treated charcoal to sample air for ethylene oxide. However, with both of these uses it is important that the adsorption targets, natural gas and ethylene oxide, be easily desorbable from the carbon, the exact opposite of what is required in a mercury vapor sequestration application. In a similar vein, in U.S. Pat. No. 6,475,461 Ohsaki describes a process for treating carbon substrates with gaseous bromine or chlorine, but then explicitly desorbs them to achieve his desired product. Seki U.S. Pat. No. 3,961,020; Yoshida and Seki et al. U.S. Pat. No. 4,174,373; and Knoblauch et al. U.S. Pat. No. 5,179,058 impregnate activated carbon with bromine to produce a catalyst for reacting nitrogen oxide with ammonia to form nitrogen and water. In this application too, the bromine of the carbon does not act as a sequestration agent, permanently tying up its target. Rather, it serves as a catalyst, taking part in a repeated series of desired chemical reactions, but not becoming permanently consumed by any of them. Perhaps it is understandable that the tenacity of carbon-bromine-mercury complexes could be overlooked.

The first sentence of paragraph [0017] refers to the "…particular advantages of using bromine…" for treatment of activated carbons for mercury control, which must mean either elemental bromine (Br_2) or the element bromine generally, and is not a specific reference to bromides (Br^-). The "…particular advantages of using bromine…" is compared to iodine (I_2), iodides (I^-), chlorine (Cl_2), and chlorides (Cl^-), but no specific comparison is made between bromides (Br^-) and chlorides (Cl^-). However, it does not make sense for Nelson to refer to the element bromine generally while specifically distinguishing between chlorine (Cl_2) and chlorides (Cl^-), and iodine (I_2) and iodides (I^-) in the same sentence. If Nelson wanted to compare both

elemental bromine (Br_2) and hydrogen bromide (HBr) to the other halides specifically disclosed in the first sentence, Nelson would have specifically distinguished between bromine (Br_2) and bromides (Br^-); therefore, "…bromine…" in the first sentence of paragraph [0017] would be interpreted as elemental bromine (Br_2), and not as the element bromine generally.

No "…particular advantages of using bromine…" are explicitly described in paragraph [0017], with the remainder of the paragraph focusing on the failure of the prior art to use bromine with activated carbon for mercury control, describing various disadvantages of other processes, such as the desorbability of Br_2, HBr, or Cl_2 from the activated carbon, or the failure of the Br_2 or HBr to act as a mercury sequestration agent. The paragraph concludes with a statement that it is understandable that "…the tenacity of carbon-bromine-mercury complexes…" could be overlooked, which must refer to complexes including either elemental bromine (Br_2) or the element bromine generally, with no specific reference to bromide (Br^-) or complexes formed therefrom. The concluding statement of paragraph [0017] is directed toward the discussion in the bulk of paragraph [0017]—the prior art fails to use bromine with activated carbon for mercury control and therefore fails to generate carbon-bromine-mercury complexes—rather than as a statement of any relative advantage of bromine over other halogens or halides. The "…tenacity of carbon-bromine-mercury complexes…" is not specifically compared to the strength of any other complexes, such as carbon-chlorine-mercury complexes, carbon-chloride-mercury complexes, carbon-iodine-mercury complexes, or carbon-iodide-mercury complexes; therefore, at best, the "…tenacity…" of the complexes described in the last sentence of paragraph [0017] can be regarded as a general statement, rather than as a comparative one. Paragraph [0017] fails to attribute any advantage of Nelson's invention specifically to HBr or Br^-, and, moreover, fails to describe or suggest that HBr or Br^- treatment of activated carbon could provide equal, let alone better, mercury removal than HCl or Cl^- treatment of the activated carbon.

At paragraph [0044], Nelson states:

> **[0044]** Production of the new mercury sorbent materials is simple and inexpensive. The carbon material and the bromine gas need simply be contacted with each other for the advantageous mercury-reactive surface compounds to quickly form. Elemental bromine is a liquid at ambient temperature, but turns to a gas at only a modestly elevated temperature. Hydrogen bromide is a gas at even ambient temperature. Using a gas-phase carbon reactant considerably simplifies the production of the sorbent and leads to the low costs which are a requirement for a sorbent to be used as a once-through duct injectant. Any common mixing method and equipment can be use to contact the gaseous bromine species with the carbon-based substrates, although it is preferably lined with corrosion-resistant material, because the bromine species can be quite corrosive. It is also preferable that the mixing of bromine gas and carbon be done at an elevated temperature. This keeps the bromine gas in the gaseous form, but also minimizes the amount of any bromine physically-adsorbed into the pores of the carbon. Such physically adsorbed bromine is not chemically bound to the carbon lattice and can be emitted in handling, in storage, and especially, when the sorbent is injected into a hot flue gas.

Paragraph [0044] expands on the general advantage described in paragraph [0021] of simple and inexpensive generation and use of the treated activated carbon sorbent. Paragraph [0044] also describes that elevated temperature during treatment can provide an advantage of reduced physical-adsorption of the elemental bromine or the hydrogen bromide, which helps to avoid emission during handling, storage, and during injection into a hot flue gas. The advantages are not described or suggested to include equal or greater mercury-removal ability of HBr- or Br^--treated activated carbon as compared to HCl- or Cl^--treated activated carbon.

The Office Action states:

> The applicant contends that the Nelson reference does not disclose HBR and Br being more effect with activated carbons than chlorides.
>
> The examiner disagrees. The Nelson reference discloses that HBr is used to provide bromide to the system. Example 5, paragraph [0083] states that the brominated PACs were treated with HBr or Br_2. Figures 14 and 15 disclose that HBr treated PAC performs better than chlorine treated PAC. Furthermore having ordinary skill in the art would expect PAC treated with HBr or Br_2 would result in a very similar modified PAC as they both include bromide (see paragraph [0092] which discloses that each of the brominated PACs performed similarly). The examiner also points to paragraph [0087] of Nelson which discloses that PAC adsorption of gaseous hydrogen bromide being ten times faster than it was for chlorine.

The Office Action states that the Nelson reference discloses that HBr is used to provide bromide to the system, and that Example 5, paragraph [0083] states that brominated PACs were treated with HBr or Br_2. Applicant cannot find the language of providing HBr "to the system" in Nelson; paragraph [0083] in Example 5 describes treating powdered activated carbons with different amounts of gaseous $Br_2(g)$ or HBr prior to injecting the activated carbons into the flue gas. However, Nelson fails to describe or suggest that treatment of activated carbon with HBr provides the same, let alone better, mercury removal efficiency as activated carbon treated with HCl or Cl^-.

With regard to figures 14 and 15, as explained above, although figures 14 and 15 illustrate HBr-treated activated carbon and Cl_2-treated activated carbon, Cl_2-treated activated carbon is not HCl- or Cl^--treated carbon and these figures fail to show any comparison to HCl- or Cl^--treated activated carbon. Figure 14 shows mercury removal percent from seven different types of activated carbons: commercial iodine activated carbon, plain Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 10 wt% HBr-treated activated carbon, 1.5 wt% Br_2-treated activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 14 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon). Paragraph [0085] states that about three times as much chlorine-gas treated activated carbon was required to achieve the same degree of mercury removal as with bromine, which can only be a comparison between the 13 wt% Cl_2-treated activated carbon and the 5 wt% Br_2-treated activated carbon which had a percent mercury removal that was about the same. Figure 15 shows mercury removal percent from five different types of activated carbons: Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 9 wt% HBr-treated

activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 15 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon).

The Office Action states that paragraph [0087] of Nelson discloses that PAC adsorption of gaseous hydrogen bromide was ten times faster than it was for chlorine. At paragraph [0087], and the following table, Nelson states:

> **[0087]** Manufacture of the elemental bromine sorbents was much faster than for the others. The elemental bromine was adsorbed and reacted with the PACs much faster than was the elemental chlorine, for example—one-hundred-times faster. This allowed for quick and inexpensive manufacture of these sorbents. See the table below with rate data in terms of grams of gas adsorbed per kilogram of PAC per minute. The PAC adsorption of gaseous hydrogen bromide, HBr(g), was ten times faster than it was for chlorine.

Gaseous Halogen	Final Loading on FGD PAC (wt %)	Adsorption Rate (gm of gas) (kg PAC • min)	Concentration in Storage Vessel (ppm)
Br_2 (g)	5%	10	0
Br_2 (g)	15%	10	0.5
HBr (g)	9%	1	N.A.
Cl_2 (g)	13%	0.1	>40

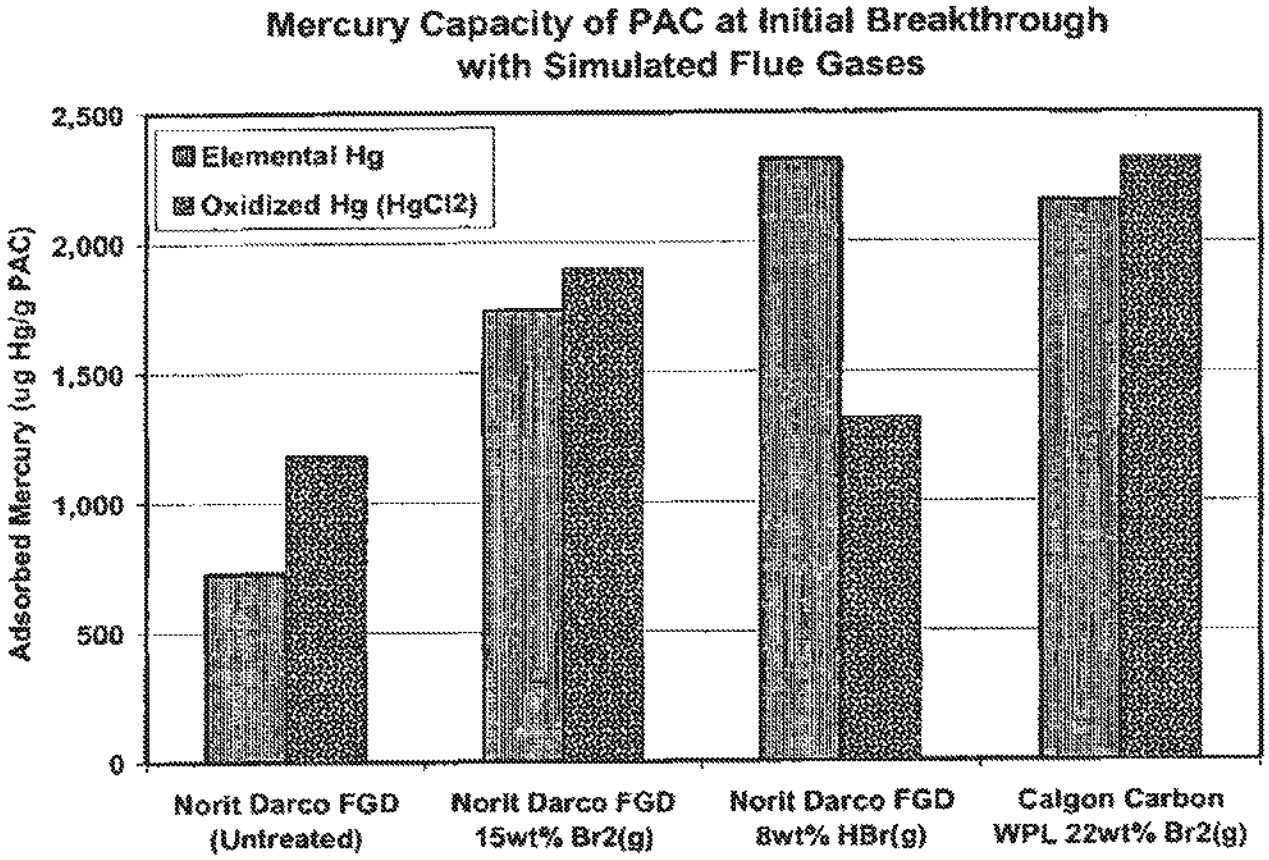
Paragraph [0087] states that the activated carbon adsorbed elemental bromine (Br_2) and hydrogen bromide (HBr) faster than chlorine (explicitly shown as Cl_2 in the Table). The table shows the amount of treatment material (Br_2, HBr, or Cl_2) absorbed on the activated carbon and the rate of adsorption of the treatment material on the activated carbon. Paragraph [0087] and the table that follows make no statements describing or suggesting mercury removal rates of the treated activated carbon.

The Office Action states that one having ordinary skill in the art would expect activated carbon treated with HBr or Br_2 would result in a very similar modified PAC as they both include bromide, citing to paragraph [0092] as allegedly disclosing that each of the brominated PACs performed similarly. Applicant notes Declaration C at item 18 which explains that Br_2 is not and does not include Br^-. At paragraph [0092], Nelson states:

> **[0092]** The brominated sorbents of this invention, on the other hand, performed very well with this difficult flue gas, achieving about 50% mercury removal with only 2 lb/MMacf of sorbent consumption and almost 70% removal at an injection rate of 4 lb/MMacf. PACs brominated with Br_2 to 5 wt % and 15 wt %, and with HBr to 9 wt % all performed similarly.

Paragraph [0092] refers to the data shown in Figure 15. However, Figure 15 shows mercury removal percent from five different types of activated carbons: Norit activated carbon, 13 wt% Cl_2-treated activated carbon, 9 wt% HBr-treated activated carbon, 5 wt% Br_2-treated activated carbon, and 15 wt% Br_2-treated activated carbon. No HCl- or Cl^--treated activated carbon is shown in Figure 15 or described in any of Examples 5-7 (the only Examples demonstrating the use of HBr-treated activated carbon).

Taken in the context of the entire document, figures 14-15 and paragraph [0092] fails to describe or suggest equivalent mercury-removal performance of HBr-treated activated carbon and Br_2-treated activated carbon. With regard to figure 14, Nelson states at paragraph [0084] that "[t]here was no much difference in performance between the various brominated samples, probably because in the duct-injection mode they only used a small fraction of their available mercury-adsorption capacity." Therefore, Nelson states that figure 14 does not provide an accurate comparison between the brominated samples, because the full mercury-adsorption capacity was not utilized. In figure 15, for all data points showing HBr-treated activated carbon, a higher sorbent injection rate was needed to achieve equivalent mercury-removal performance as the Br_2-treated activated carbons (i.e., the HBr data points for a given mercury-removal percentage are always to the right of the Br_2 data points for that mercury-removal percentage), indicating HBr-treated activated carbon to have less mercury-removal ability than Br_2-treated activated carbons. In figure 12, reproduced below, Nelson compares the mercury capacity of untreated activated carbon, 15 wt% Br_2-treated activated carbon, 8 wt% HBr-treated activated carbon, and 22 wt%Br_2-treated activated carbon.



Paragraph [0080], discussing figure 12, states that:

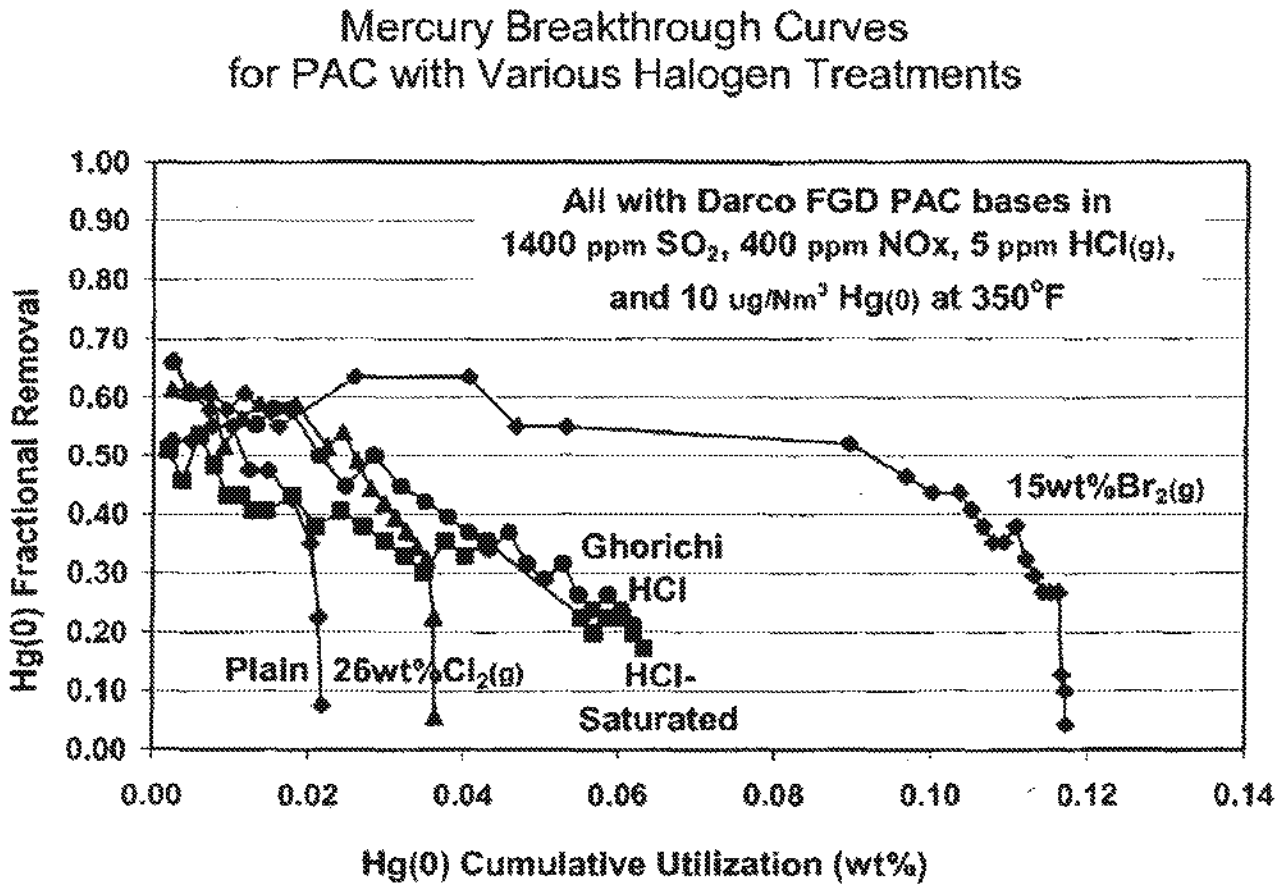
> ...the brominated carbons adsorbed considerably more mercury species than the untreated version, with the improvements averaging about 100%. Importantly, the bromine-gas-treated sorbents removed about as much oxidized mercury-chloride from the test gases as elemental mercury, indicating performance improvements with both kinds of common flue-gas mercury species.

Both of the Br_2-treated activated carbons in figure 12 showed increased removal of both elemental mercury and oxidized mercury as compared to the untreated activated carbon. However, the HBr-treated activated carbon in figure 12 had hardly any improvement in removal of oxidized Hg compared to the untreated activated carbon, which paragraph [0080] describes as one of two common flue-gas mercury species, and that the removal of both of these species is "important."

Nelson does not portray the mercury removal abilities of activated carbon treated with Cl_2 outside the flue gas as equivalent to that of activated carbon treated with HCl outside the flue gas.

At figure 11, reproduced below, Nelson shows mercury breakthrough curves for elemental mercury removal from a non-flue gas "mercury-challenge gas" for powdered activated carbon with various halogen treatments performed outside the flue gas.

Figure 11.



At paragraph [0077], reproduced below, Nelson discusses figure 11.

> **[0077]** The sample that had been exposed to gaseous chlorine, $Cl_2(g)$, exhibited some improvement in mercury removal performance relative to the plain, untreated PAC. Two samples of HCl-treated PACs showed even higher ultimate mercury capacities, but poorer kinetics. One of these samples had been pretreated by flowing gas-phase HCl through the PAC sample until it no longer added mass. The other, acquired from Ghorishi et al., was produced by a dilute liquid-phase HCl treatment described in their publications. The elemental mercury breakthrough curves of the two HCl-treated PACs were very similar, exhibiting a slow and steady drop-off in performance, indicative of poor mercury adsorption kinetics. In contrast, the brominated sample of this invention broke through very sharply and captured more than five times the elemental mercury of the untreated PAC.

At paragraph [0077], Nelson states that the HCl-treated powdered activated carbons had higher capacities for elemental mercury, but showed poorer kinetics. Although some information about how the Cl_2- and HCl-treated activated carbons would behave in a flue gas can be learned from figure 11, a flue gas contains additional species that were not present in the "mercury challenge gas", and, further, can include other forms of mercury other than the elemental mercury measured by the breakthrough test of figure 11, such as oxidized mercury. Nelson does not perform mercury-removal testing of HCl-treated activated carbons in a flue gas. However, Nelson in figure 11, paragraph [0077], and paragraph [0012] refers to HCl-treated activated carbon from Ghorishi et al., which had about the same performance in figure 11 as the HCl-saturated activated carbon prepared by Nelson. At paragraph [0012] Nelson describes a publication by this author, Ghorishi, S.B., Keeney, R.M., Jozewicz, W.S., Serre, S.D. and Gullett, B.K., 2001, In-flight capture of elemental mercury by a chlorine-impregnated activated carbon, Annual Air and Waste Management Association(AWMA) Conference, Orlando, FL, Vol. 24, No. 28 ("Ghorishi").

Ghorishi's conclusion at page 11 states that over 80% mercury removal was accomplished from a flue gas using activated carbon treated outside the flue gas with HCl. Comparing these results to Nelson's results shown in figures 14 and 15, 80% mercury removal is better than the about 58% removal by Cl_2-treated activated carbon in figure 14, is better than the about 22% removal by Cl_2-treated activated carbon in figure 15, and is better than the maximum mercury removal of HBr-

or Br_2-treated activated carbons in figure 15. Therefore, one of ordinary skill in the art hypothetically reviewing Nelson would not only conclude that activated carbon treated outside the flue gas with HCl not only has higher capacity for elemental mercury than Cl_2-treated activated carbon as shown in Nelson's figure 11, but also from comparing Ghorishi to Nelson that activated carbon treated outside the flue gas with HCl has better mercury removal performance in flue gas than Cl_2-treated activated carbon. Accordingly, even if, merely for the sake of argument, one of ordinary skill in the art were to conclude from Nelson's statements at paragraph [0092] that activated carbon treated with HBr or Br_2 outside the flue gas have similar mercury removal abilities, this would not lead to the conclusion that activated carbon treated with HBr outside the flue gas has better mercury removal abilities than activated carbon treated with HCl outside the flue gas.

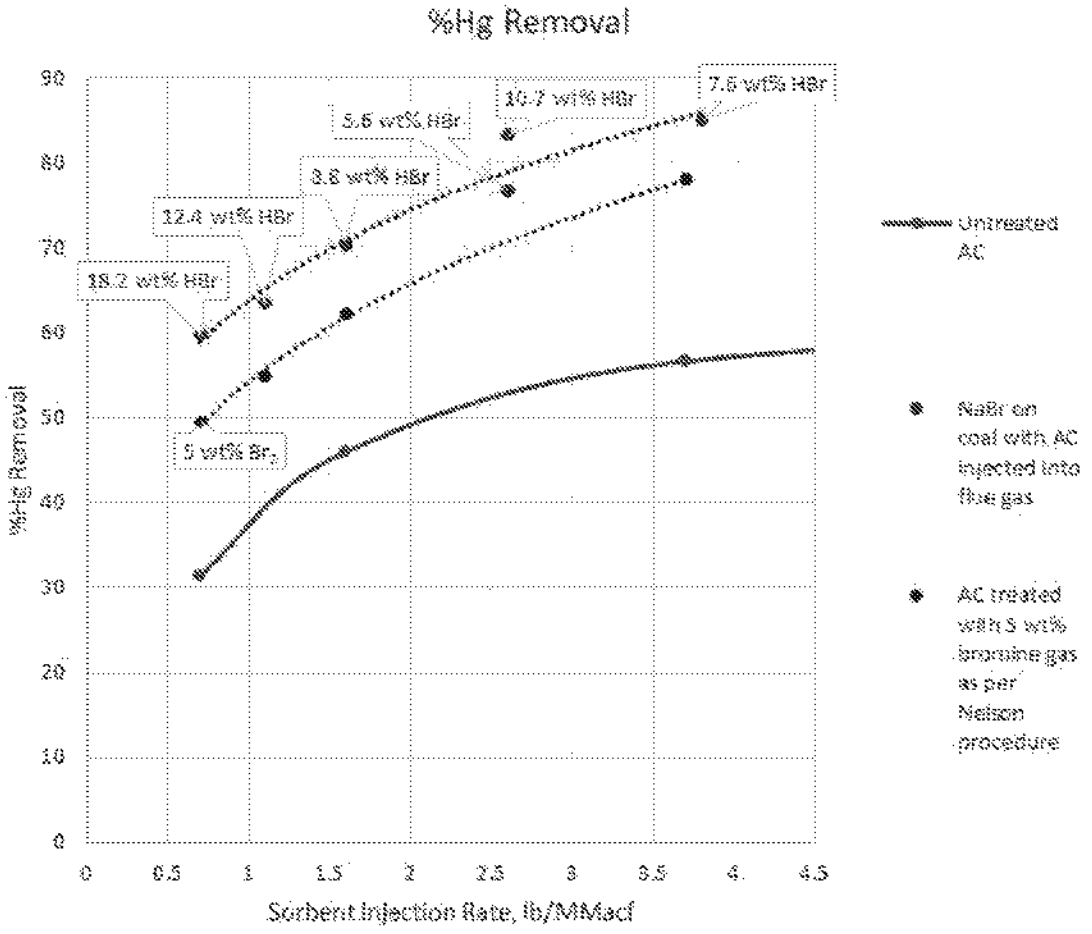
Nelson never directly compares the mercury-removal ability of HBr-treated activated carbon with HCl-treated activated carbon. With Nelson clearly indicating that HBr-treated activated carbon has inferior mercury-removal ability as compared to Br_2-treated activated carbon, and that HCl-treated activated carbon has superior mercury-removal ability as compared to Cl_2-treated activated carbon, there is no way that one of ordinary skill in the art hypothetically considering Nelson could conclude that HBr-treated activated carbon has equivalent or superior mercury-removal ability compared to HCl-treated activated carbon.

I(B). In-flight promotion versus treatment outside the flue gas.

I(B)(1). In-flight promotion with HBr or Br^- promoters is more effective for mercury removal than treating the sorbent with HBr, Br^-, or Br_2 outside the mercury-containing gas.

The inventors of the present application have discovered that by combusting coal in the presence of a HBr or Br^- promoter, and by placing an activated carbon sorbent in the mercury-containing gas, as presently claimed, the activated carbon can be promoted by the promoter in-flight in the mercury-containing gas, and further, that in-flight HBr or Br^- promotion of the activated carbon is more effective for mercury removal than use of an activated carbon that is treated with HBr, Br^-, or Br_2 outside the flue gas.

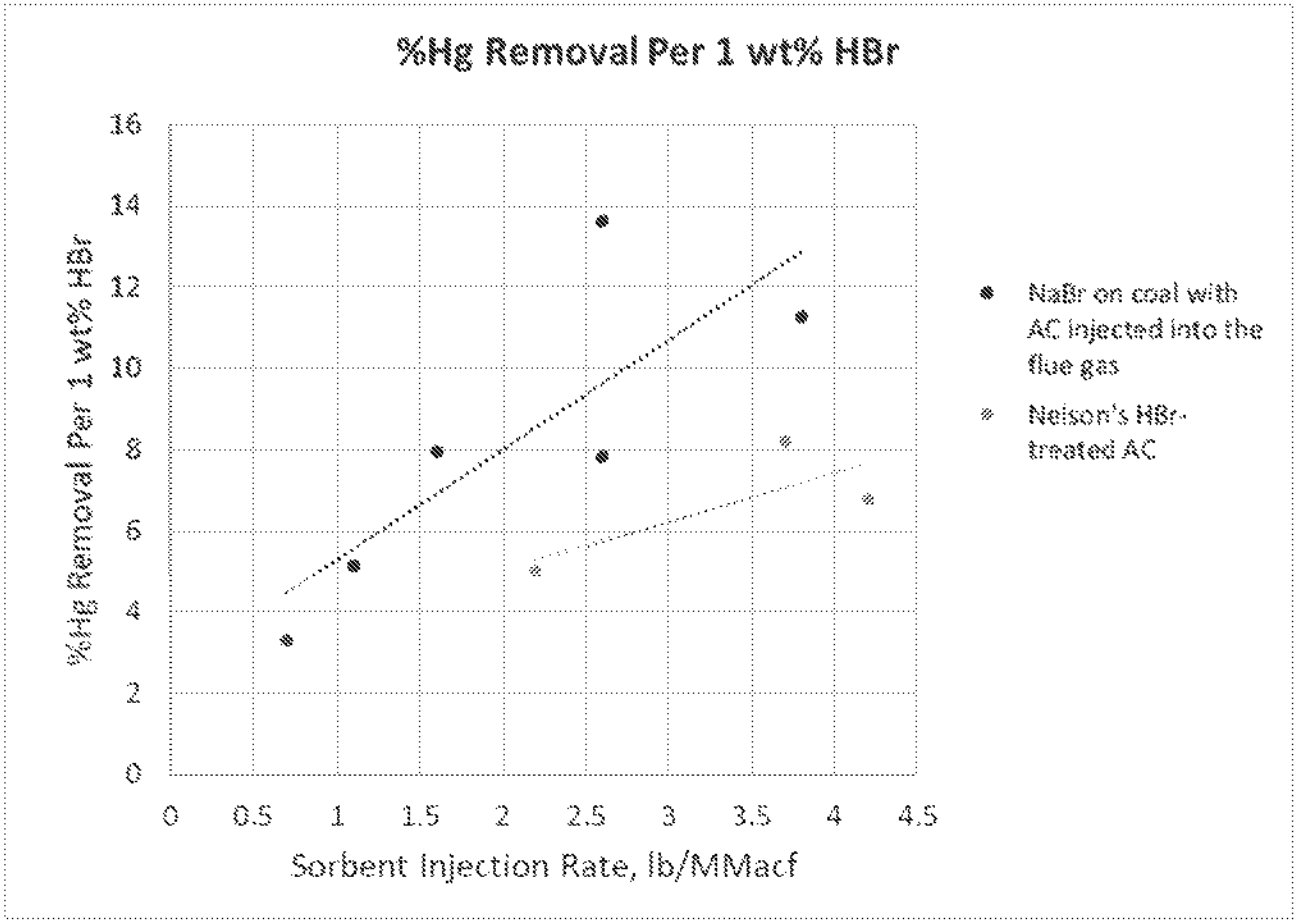
As explained in Declaration B, pilot-scale testing was performed with activated carbon alone (untreated) injected into the flue gas, the activated carbon treated with Br_2 outside the flue gas as per the Nelson procedure (see, Declaration B at item 7), and with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The same activated carbon was used for each sample. See, Declaration B at items 8-11. The plot given in Declaration B at item 11 is reproduced below.



The data in the plot above from item 11 of Declaration B show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas (in-flight promotion with Br^-) provided a higher percent of mercury removal at all tested sorbent injection rates as compared to the activated carbon alone (untreated) and compared to the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure.

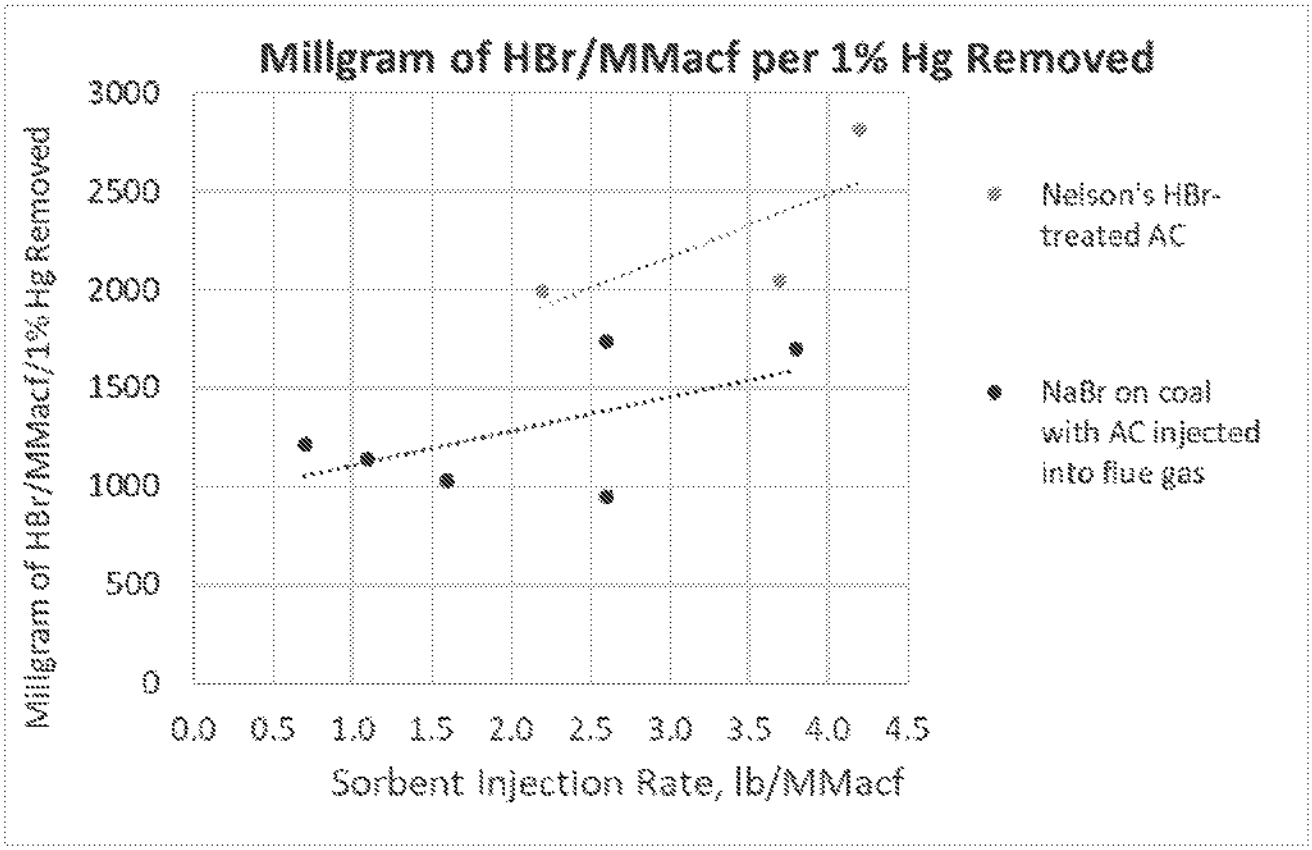
With NaBr added to the coal and activated carbon injected into the flue gas, there was a significant reduction in the amount of sorbent required to acheive similar mercury removal compared to the activated carbon treated with Br_2 outside the flue gas. For example, to acheive 70% mercury removal, 2.5 lb/MMacf of Br_2-treated carbon was required, as compared to 1.6 lb/MMacf with NaBr added to the coal and activated carbon injected into the flue gas; an additional (2.5-1.6/1.6)*100% or 56% treated sorbent was required to achieve the same leval of mercury removal. See, Declaration B at items 2-5 and 12.

The percent mercury removal per 1 wt% HBr versus the sorbent injection rate was compared with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas using the pilot-scale plant, and with Nelson's activated carbon treated with HBr outside the flue gas. The data for Nelson's activated carbon treated with HBr outside the flue gas was taken directly from Nelson. The first plot given in Declaration B at item 13 is reproduced below, but only showing the HBr data.



The data in the plot above, derived from the first plot at item 13 of Declaration B, show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 2x) percent mercury removal per 1 wt% HBr at all tested sorbent injection rates as compared to Nelson's activated carbon treated with HBr outside the flue gas. See, Declaration B at item 14.

The data from the pilot-scale plant was also plotted to show the milligrams of HBr/MMacf per 1% mercury removal versus the sorbent injection rate with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for Nelson's activated carbon treated with HBr outside the flue gas. The second plot given in Declaration B at item 13 is reproduced below.



The data in the plot above, derived from the second plot at item 13 of Declaration B, show that NaBr added to coal prior to introduction to the furnace with injection of untreated activated

carbon into the flue gas provided a significantly lower milligrams of HBr/MMacf per 1% mercury removal at all tested sorbent injection rates as compared to Nelson's activated carbon treated with HBr outside the flue gas, indicating more efficient (approximately 2x) use of HBr for mercury removal during in-flight promotion of activated carbon than treatment of activated carbon outside the flue gas. See, Declaration B at item 14.

As explained at item 9 of Declaration D, Nelson's experimental setup in Examples 5 and 7 and the experimental setup described at item 8 of Declaration B inject activated carbon sorbent into a flue gas upstream of an ESP and use no scrubber, making the procedures comparable. However, the higher HCl concentration in Nelson's Example 7 flue gas allows for easier mercury removal, due to HCl acting as a promotor of the activated carbon, as compared to the pilot-scale setup described at item 8 of Declaration B. Further, the higher mercury concentration in Nelson's Example 5 makes it easier for Nelson's sorbents to remove the same overall percentage of mercury from the flue gas, as compared to the pilot-scale setup described at item 8 of Declaration B. Therefore, if Nelson's Example 5 and 7 HCl and mercury concentrations were changed to match those of the pilot-scale setup described at item 8 of Declaration B, Nelson's sorbents would remove a lower percentage of mercury than found in Nelson's Examples 5 and 7, meaning that Nelson's sorbents would exhibit an even lower (and less efficient) percent mercury removal per 1 wt% HBr at any sorbent injection rate than shown in the second plot above (derived from the first plot at item 13 of Declaration B), and would exhibit an even higher (and less efficient) milligrams of HBr/MMacf per 1% mercury removal at any sorbent injection rate than shown in the third plot above (derived from the second plot at item 13 of Declaration B).

I(B)(2). There is no way a person of ordinary skill in the art could predict that in-flight promotion of a sorbent with HBr or Br^- promoters is more effective for mercury removal than use of a sorbent that is treated with the same promoters outside the flue gas.

The M.P.E.P. at the beginning of § 2143.02 states (emphasis added) "[a] rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, *and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art.*"

As admitted by the Office Action, Felsvang fails to describe or suggest HBr or Br^- promoters. Felsvang also fails to describe or suggest that treatment of an activated carbon with a HCl or Cl^- additive outside of flue gas has any advantages over in-flight promotion of an activated carbon with an HCl or Cl^- promoter. Further, as shown herein at **I(D)**, treatment of activated carbon outside the flue gas with HCl provides better mercury removal than in-flight promotion of activated carbon with HCl or Cl^-. Therefore, a person of ordinary skill in the art hypothetically having Felsvang in-hand would have no clue that in-flight promotion of activated carbon with a halide could give the same or better percent mercury removal over halide treatment outside of the flue gas, and would be led away from Felsvang's process if they investigated the relative mercury removal of treatment of the activated carbon with HCl or Cl^- outside the flue gas versus in-flight treatment with HCl or Cl^- in the flue gas.

Nelson mentions treating activated carbon outside of flue gas, and then adding the activated carbon to flue gas. Nelson fails to describe or suggest in-flight promotion of an activated carbon with a halide in the flue gas. Therefore, a person of ordinary skill in the art hypothetically having Nelson in-hand would *also* have no idea that in-flight promotion of activated carbon with a halide could have any advantages over halide treatment outside of the flue gas.

There is no way to predict from the presently cited references the superior mercury capture discovered by the present inventors that occurs when activated carbon is promoted with HBr or Br^- promoters in-flight in the mercury-containing gas, as occurs when following the present claims. The Office Action states at the end of the second full paragraph on page 4 that Nelson's additives would be combined with Felsvang's process "...so as to provide an effective carbon sorbent for mercury." However, a person of ordinary skill in the art would have no idea that in-flight promotion with HBr or Br^- promoters could work better than Nelson's HBr-treatment outside the flue gas. Felsvang fails to describe or suggest that in-flight promotion provides a sorbent with even the same (let alone superior) properties as a sorbent treated outside the flue gas, and, as explained herein at **I(D)**, treatment of activated carbon outside the flue gas with HCl actually provides better mercury removal than in-flight promotion of activated carbon with HCl or Cl^-; similarly, Nelson fails to describe in-flight promotion, let alone that in-flight promotion provides the same or superior mercury removal ability as compared to treatment outside the flue gas.

The only way that a person of ordinary skill in the art could discover that in-flight promotion of activated carbon with HBr or Br^- promoters is more effective for mercury removal than HBr treatment outside the flue gas would not be from the cited references alone; instead, the person of ordinary skill would need to actually modify Felsvang with Nelson as alleged, and then compare the mercury removal of Felsvang's modified process to Nelson's sorbent treated outside the flue gas.[8] However, the person of ordinary skill carrying out such a combination would be surprised to find that in-flight promotion with HBr or Br^- is more effective for mercury removal than HBr treatment of the sorbent outside the flue gas. The process giving rise to these surprising results was discovered by the inventors of the present application. Surprising results are a hallmark of patentability; only by having the present application in-hand could such results be predicted, and a need to resort to hindsight analysis to predict the advantages of the combination asserted by the Office Action is indicative that the presently claimed invention is not obvious over the cited references. Accordingly, independent claims 27, 54, and 55 are patentable over Felsvang in view of Nelson for at least this additional reason.

I(B)(3). Reply to Examiner's response to arguments.

The Office Action states:

> II(B)(1). The applicant contends that the bromide promoters are more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas. The applicant further provides a graph to demonstrate these unexpected results.

[8] In the event the Examiner intends to argue that such advantages are inherent in the cited art, Applicant notes that the claimed invention is not specifically disclosed in the prior art. The Examiner cannot reason inherency in a §103 context based on a mere proposed or hypothetical combination of features from cited references. Such reasoning would merely reflect the Examiner's reliance on impermissible hindsight. See, M.P.E.P. § 2112(IV).

> These unexpected results are not commensurate with the scope of the claims. The applicant is claiming HBr and Br- while the graph only demonstrates HBr. Further the comparisons between the prior art and that of the current invention do no demonstrate unexpected results. The applicants data is unclear as it is either HBr (as specified in the actual graph) or NaBr (as specified in the legend). Further the 18.2 data point has no labelling on what the promoter is. None of the data point include what amount is being specified, wt%, vol% etc. The results would be expected by one having ordinary skill in the art as the wt% (if we are to assume the amount specified is wt) of the amount supported on the upper most line is greater than that of the wt% on the middle trending line. Further claim 1 does not include NaBr on coal. Lastly is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods.

As explained in Declaration C at item 28, when NaBr is added to coal, gaseous NaBr is formed in the flue gas, and HBr is formed in the flue gas. As explained in Declaration C at item 33, NaBr is a salt that includes Na^+ and Br^-. Therefore, placing NaBr on the coal (as specified in the legend of the plot given at item 11 of Declaration B) results in formation of HBr and Br^- in the flue gas (as specified in the graph), and the results shown are commensurate with the scope of the claims. In the graphs in Declaration B all halides in the flue gas formed from halide salts placed on the coal are assumed to be in the form of the respective hydrogen halide for comparative purposes, although these could be in the form of the gaseous halide salt or the hydrogen halide—this assumption is made for consistency across all the graphs in Declaration B. As the graphs show trends between %Hg removal and halide content of the flue gas, so long as the amounts of the different halides present in the flue gas are compared in a consistent way it does not matter whether they are in the form of the hydrogen halide or the halide ion in the flue gas for purposes of comparing relative %Hg removal.

The data table at item 10 of Declaration B shows that the 18.2 data point of the plot shown at item 11 corresponds to 18.2 wt% HBr, and that all of the labels on the data set "NaBr on coal with AC injected into flue gas" indicate wt% HBr. Additionally, for increased clarity, Declaration B is revised to indicate wt% and properly labels the 18.2 data point in the plot shown at item 11.

The Office Action states that the results would be expected by one having ordinary skill in the art because the amount of HBr on the upper line, representing NaBr on coal with AC injected into the flue gas, are greater than the wt% of the middle trending line, representing AC treated with

5 wt% bromine outside the flue gas as per the Nelson procedure. Applicant does not agree that the results are not unexpected. The unexpected results described in the Response are that in-flight promotion of a sorbent with HBr or Br^- promoters is more effective for mercury removal than use of a sorbent that is treated with the same promoters outside the flue gas (as explained herein at **I(B)**, using the first and second plots from item 13 of Declaration B), and that in-flight promotion with HBr or Br^- promoters is more effective for mercury removal than in-flight promotion with HCl or Cl^- promoters (as explained herein at **I(C)**). Applicant included the plot at item 11 primarily to show that adding NaBr to coal and injecting untreated AC into the flue gas is an effective way to remove mercury.

The Office Action states that it is not clear whether the results are because of different components being reacted or because of the different method being used. However, all of the data shown in the plot at item 11 of Declaration B is shown in the tables at items 9 and 10 of Declaration B, which is all derived from the same pilot-scale test unit described at item 8 of Declaration B, using the same components, the same type of AC, and the same method, with the only variations between the data sets being the type of treatment of the AC (i.e., no treatment, treatment with Br_2 outside the flue gas prior to injection, and adding NaBr to coal while injecting untreated AC into the flue gas); item 11 of Declaration B has been revised to clarify this point.

The Office Action states:

> The second graph on page 14 comparing NaBr on coal to HBr treated AC and it is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods. To do that the graph would have to be comparing HBr in the present method to HBr in the prior art method. Further the applicant has not shown the amount of promoter supported by each (wt%) data point. Lastly claim 1 does not include NaBr on coal.

The second graph on page 12 of the last Response was the first graph from item 13 of Declaration B. The Office Action states that the components used must be the same for both methods, such that the graph compares HBr in the present method to HBr in the prior art method. However, as explained in Declaration C at item 28, when NaBr is added to coal, gaseous NaBr is formed in the flue gas, and HBr is formed in the flue gas. As explained in Declaration C at item 33, NaBr is a salt that includes Na^+ and Br^-. Therefore, placing NaBr on the coal results in formation of

HBr and Br^- in the flue gas. All of the NaBr is assumed to be converted to HBr in the graph, such that the components being compared are the same for both methods.

Although the data set "NaBr on coal with AC injected into flue gas" is shown in the table in item 10 and is derived from the pilot-scale test unit described at item 8 of Declaration B, while the data set "Nelson's HBr-treated AC" is from Nelson, as explained at item 9 of Declaration D and at **I(B)(1)** herein, data from Nelson's experimental setup and from the pilot-scale unit of item 8 of Declaration B are validly comparable----further, Nelson's conditions used in Examples 5 and 7 allow for easier mercury removal than in the pilot-scale unit of item 8 of Declaration B, such that if Nelson's Example 5 and 7 HCl and mercury concentrations were changed to match those of the pilot-scale setup described at item 8 of Declaration B, Nelson's sorbents would remove a lower percentage of mercury than found in Nelson's Examples 5 and 7.

The Office Action states that "the application has not shown the amount of promoter supported by each (wt%) data point." However, the y-axis indicates the percent mercury removal per 1 wt% HBr; therefore, the wt% promoter data is part of what is shown on the graph. Further, the table at item 10 indicates the specific amount of HBr for each data point.

The Office Action states:

> The third graph on page 13 compares HBr treated AC and NaBr on coal with AC injected into flue gas. The graph states Milligram of HBr/MMacf/1%Hg Removed. As HBr is not a part of the current application data points it is unclear how to interpret this graph. Claim 1 does not include NaBr on coal. Further is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods.

The third graph on page 13 of the last Response was the second graph from item 13 of Declaration B. The Office Action states that HBr is not a part of the current application data points, and that the claims do not include NaBr on coal. However, as explained in Declaration C at item 28, when NaBr is added to coal, gaseous NaBr is formed in the flue gas, and HBr is formed in the flue gas. As explained in Declaration C at item 33, NaBr is a salt that includes Na^+ and Br^-. Therefore, placing NaBr on the coal results in formation of HBr and Br^- in the flue gas. All of the NaBr is assumed to be converted to HBr in the graph, such that the components being compared are the same for both methods.

Although the data set "NaBr on coal with AC injected into flue gas" is shown in the table in item 10 and is derived from the pilot-scale test unit described at item 8 of Declaration B, while the data set "Nelson's HBr-treated AC" is from Nelson, as explained at item 9 of Declaration D and at **I(B)(1)** herein, data from Nelson's experimental setup and from the pilot-scale unit of item 8 of Declaration B are validly comparable---further, Nelson's conditions used in Examples 5 and 7 allow for easier mercury removal than in the pilot-scale unit of item 8 of Declaration B, such that if Nelson's Example 5 and 7 HCl and mercury concentrations were changed to match those of the pilot-scale setup described at item 8 of Declaration B, Nelson's sorbents would remove a lower percentage of mercury than found in Nelson's Examples 5 and 7.

The Office Action states:

> I(B)(2). The applicant contends that there is no way a person of ordinary skill in the art could predict from the cited references that in-flight promotion of a sorbent with bromide promoters is more effective for mercury removal.
>
> The examiner contends that the applicant has not established that it is more effective.

Applicant respectfully disagrees. As explained above, the data does provide evidence that in-flight promotion of a sorbent with HBr or Br^- promoters is more effective for mercury removal than use of a sorbent that is treated with the same promoters outside the flue gas.

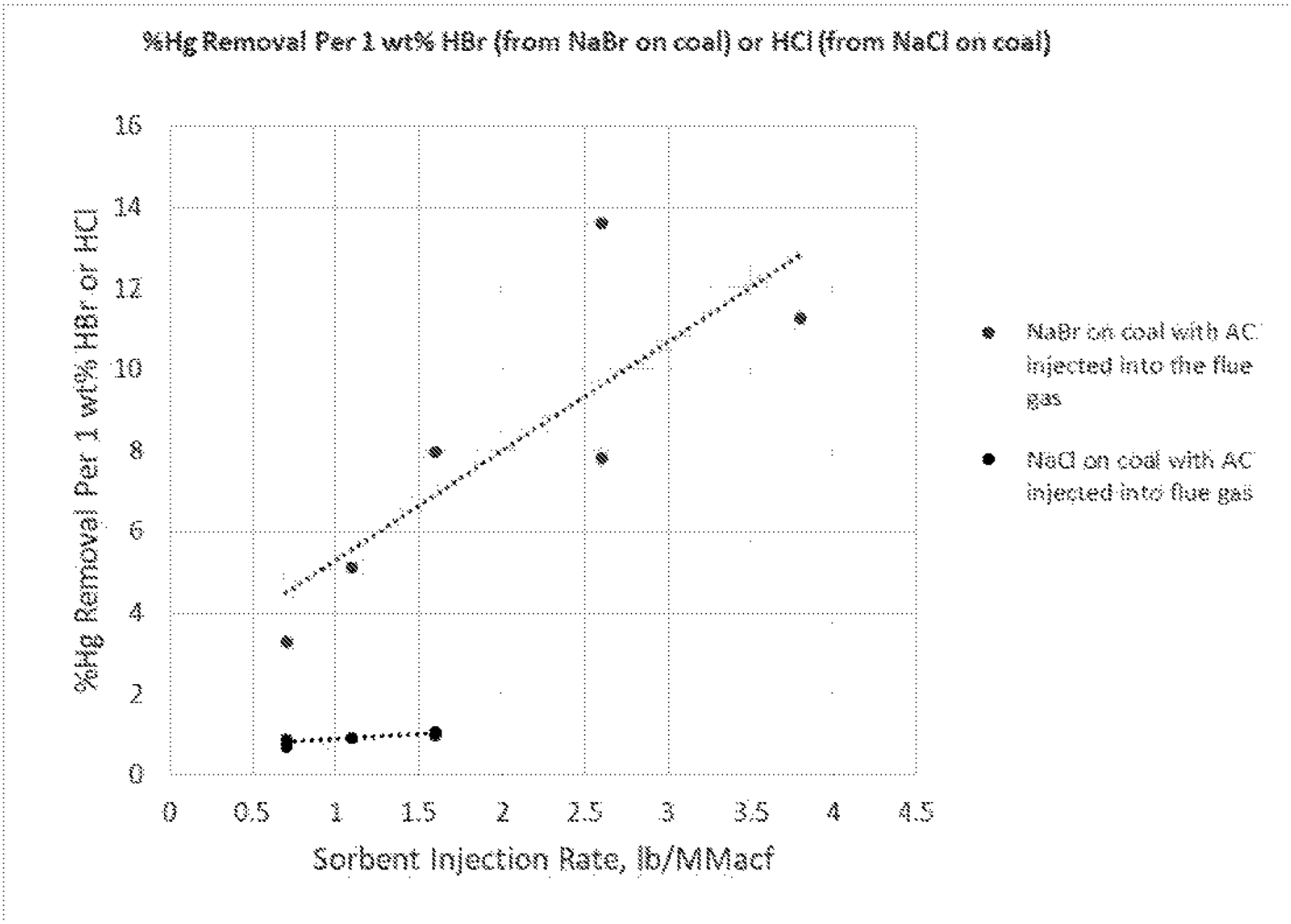
I(C). In-flight promotion with HBr or Br^- versus HCl or Cl^-.

I(C)(1). In-flight promotion with HBr or Br^- promoters is more effective for mercury removal than in-flight promotion with HCl or Cl^- promoters.

The inventors of the present application have discovered that that in-flight HBr or Br^- promotion of an activated carbon in a mercury-containing flue gas is significantly more effective for mercury removal than in-flight HCl or Cl^- promotion of an activated carbon.

As explained in Declaration B, pilot-scale testing was performed with NaBr or NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The same activated carbon was used for each sample. See, Declaration B at items 8-10. The

first plot given in Declaration B at item 13 is reproduced below, but not showing the data from Nelson's HBr-treated AC.



The data in the plot above, derived from the first plot at item 13 of Declaration B, show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 6-8x) percent mercury removal per 1 wt% HBr or HCl at all tested sorbent injection rates compared to the NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. See, Declaration B at item 14.

I(C)(2). There would be no way for a person of ordinary skill in the art to predict this advantage from the from the cited references.

As explained herein at **I(A)(2)(d)**, Nelson fails to describe or suggest that treatment of activated carbon with HBr or Br^- could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to Felsvang.

The only way that a person of ordinary skill in the art could discover that in-flight promotion with HBr or Br^- promoters is more effective for mercury removal than in-flight promotion with HCl or Cl^- promoters would not be from the cited references alone; instead, the person of ordinary skill would need to actually modify Felsvang with Nelson as alleged, and then to compare the mercury removal of Felsvang's modified process to Felsvang's original process.[9] However, the person of ordinary skill carrying out such a combination would be surprised to find that promotion of activated carbon with HBr or Br^- could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to Felsvang. The process giving rise to these surprising results was discovered by the inventors of the present application. Surprising results are a hallmark of patentability; only by having the present application in-hand could such results be predicted, and a need to resort to hindsight analysis to predict the advantages of the combination asserted by the Office Action is indicative that the presently claimed invention is not obvious over the cited references. Accordingly, independent claims 27, 54, and 55 are patentable over Felsvang in view of Nelson for at least this additional reason.

I(C)(3). Reply to Examiner's response to arguments.

The Office Action states:

[9] In the event the Examiner intends to argue that such advantages are inherent in the cited art, Applicant notes that the claimed invention is not specifically disclosed in the prior art. The Examiner cannot reason inherency in a §103 context based on a mere proposed or hypothetical combination of features from cited references. Such reasoning would merely reflect the Examiner's reliance on impermissible hindsight. See, M.P.E.P. § 2112(IV).

> II(C)(1). The applicant contends that one having ordinary skill in the art would not have predicted in-flight chloride promotion of activated carbon to be more effective for mercury removal that in-fligh chloride promotion.
>
> The examiner disagrees. Nelson discloses that bromide is a better promoter of AC for the purpose of mercury removal as shown above. Therefore one having ordinary skill in the art would expect an inflight bromide promoted sorbent to superior to and inflight chloride promoted sorbent.
>
> II(C)(2). The applicant argues that one having ordinary skill in the art would not predict this advantage from the cited references.
>
> The examiner disagrees for the reasons stated above.

However, as explained herein at **I(A)(2)(d)** and **I(A)(3)**, Nelson fails to describe or suggest that HBr-treatment of activated carbon provides better mercury removal ability than HCl-treated activated carbon; therefore, there is no way one of ordinary skill in the art could reasonably predict from Felsvang and Nelson that treatment of activated carbon with HBr or Br^- could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to Felsvang.

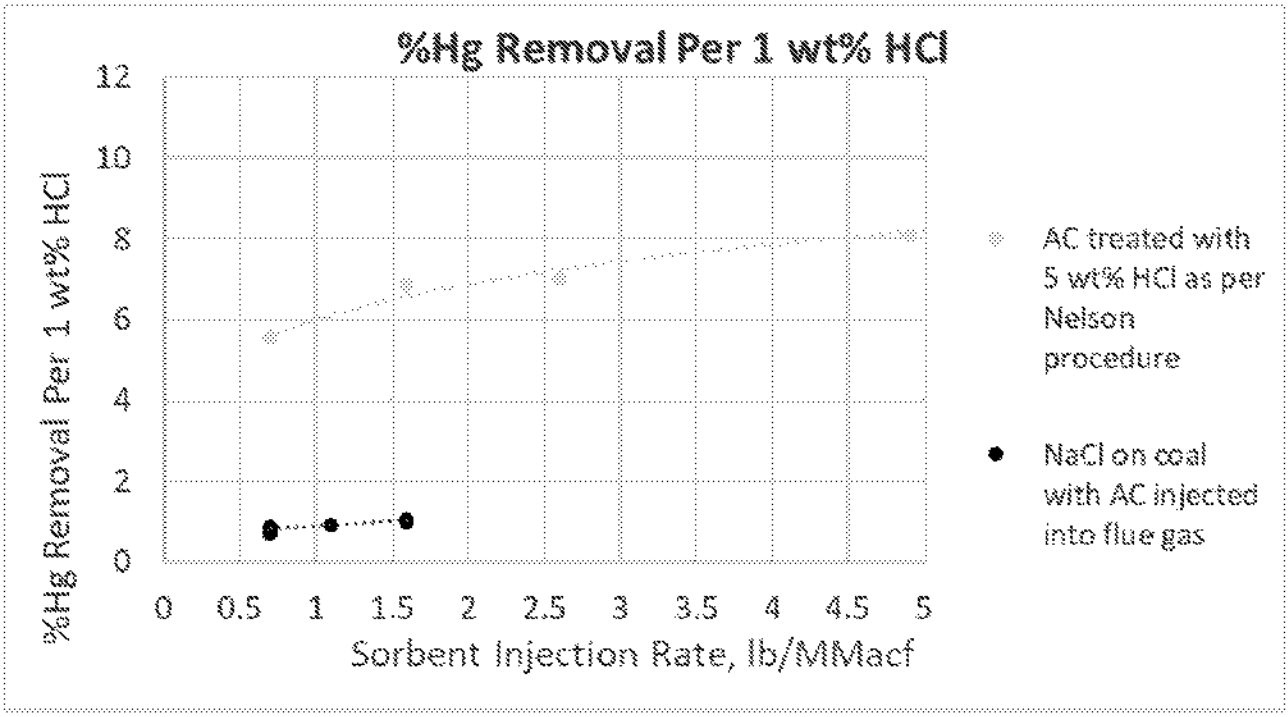
I(D). A person of ordinary skill in the art would find that treatment of activated carbon outside the flue gas with HCl as per Nelson's process actually provides more effective mercury removal per wt% HCl than treatment of activated carbon with HCl or Cl^- in the flue gas.

I(D)(1). Even if a person of ordinary skill in the art compared the mercury removal of Felsvang to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties per wt% HCl.

As explained herein at **I(A)(2)(c)**, Felsvang fails to describe or suggest that in-flight promotion of activated carbon with HCl or Cl^- in the flue gas provides better mercury removal than treatment of activated carbon outside the flue gas with HCl. A person of ordinary skill would notice the extremely poor improvement (if any improvement actually occurred) caused by addition of activated carbon in Felsvang's sole Example showing the use of activated carbon (Example 4) (see **I(A)(2)(c)** herein) and would question whether Felsvang's process is an efficient way to use

activated carbon for mercury removal as compared to Nelson's process. Merely for the sake of argument, if one of ordinary skill in the art were to investigate Felsvang's embodiments including activated carbon and compare the relative mercury-removal ability to that of activated carbon treated with HCl outside the flue gas, as explained below, they would find that treatment of activated carbon outside the flue gas with HCl as per Nelson's process actually provides more effective mercury removal per wt% HCl than treatment of activated carbon with HCl or Cl^- in the flue gas, which would lead one of ordinary skill in the art away from using Felsvang's process.

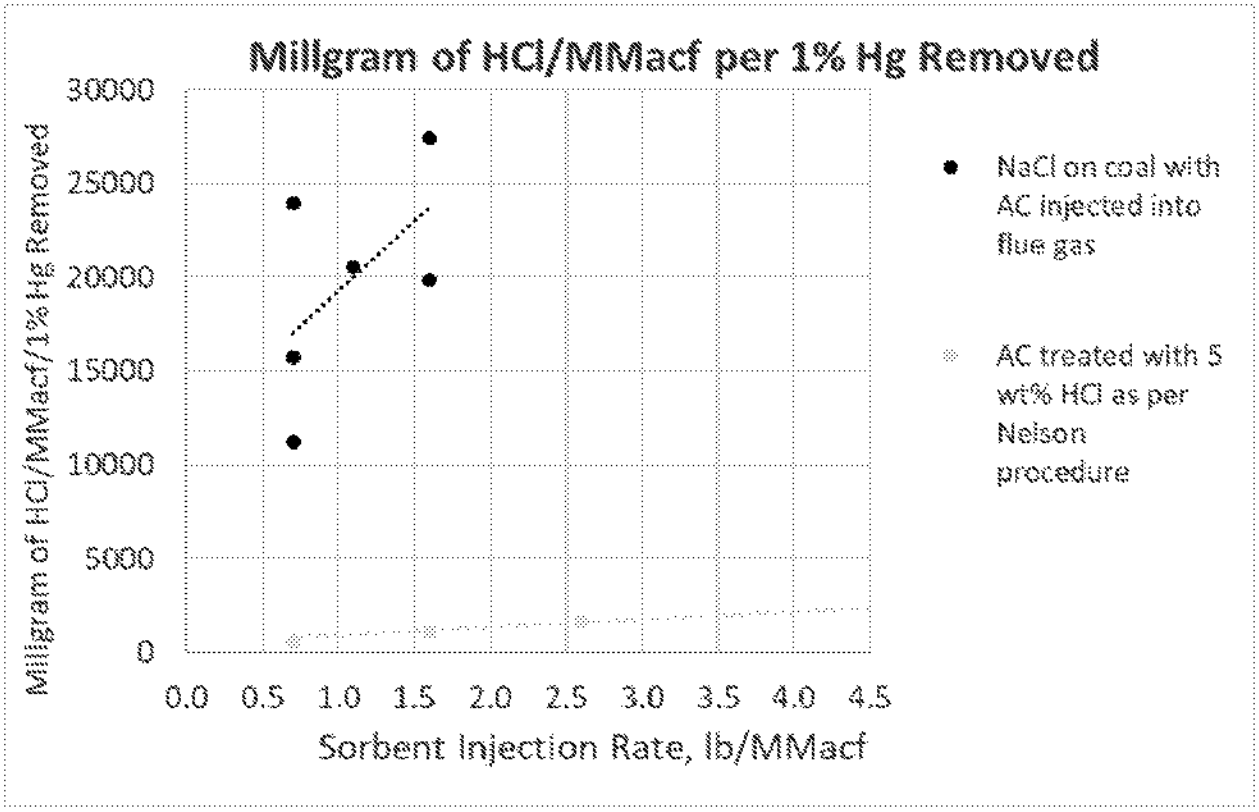
As explained in Declaration B, pilot-scale testing was performed with activated carbon treated with HCl outside the flue gas as per the Nelson procedure (see, Declaration B at item 7), and with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The same activated carbon was used for each sample. See, Declaration B at items 8-10. The first plot given in Declaration B at item 15 is reproduced below.



The data in the plot above from the item 15 of the Declaration B show that activated carbon treated with HCl outside the flue gas as per the Nelson procedure provided a much higher percent of mercury removal per 1 wt% HCl at all tested sorbent injection rates as compared to NaCl added to

coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. See, Declaration B at item 16.

The pilot-scale data was also plotted to show the milligrams of HCl/MMacf per 1% mercury removal versus the sorbent injection rate with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure. The second plot given in Declaration B at item 15 is reproduced below.



The data in the second plot above from item 15 of Declaration B show that the milligrams of HCl/MMacf per 1% mercury removal versus the sorbent injection rate with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas was significantly higher as compared to the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure, indicating more efficient use of HCl for mercury removal by treatment of activated carbon outside the flue gas than by promotion in-flight.

I(D)(2). Reply to response to arguments.

The Office Action states:

> I(D)(2). The applicant contends that "Even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with Chloride in the flue gas to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties"
>
> This appears to be merely conjecture by the applicant as no factual evidence has been presented.
>
> The graphs on pages 20 and 22, has NaCl compared to HCl. It is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods. Further the examiner points to the y-axis which has HCl which is not included in one set (NaCl) of the data points so it is unclear how the data points are being obtained.

The Office Action states that Applicant's contention that a person of ordinary skill in the art comparing Felsvang's process to treatment of activated carbon with HCl outside the flue gas would find that in-flight promotion provides less mercury removal is conjecture and is unsupported by factual evidence. However, Applicant's contention is not conjecture and is supported by data provided in Declaration B, as described herein at **I(D)(1)**; therefore, Applicant does not understand this statement of the Office Action.

The Office Action states that the graphs have NaCl compared to HCl, and that the y-axis has HCl which is not included in one set (NaCl) of the data points so it is unclear how the data points are being obtained. However, as explained in Declaration C at item 28, when NaCl is added to coal, gaseous NaCl is formed in the flue gas, and HCl is formed in the flue gas. NaCl is a salt that includes Na^+ and Cl^-. Therefore, placing NaCl on the coal results in formation of HCl and Cl^- in the flue gas. In the graphs in Declaration B all halides in the flue gas formed from halide salts placed on the coal are assumed to be in the form of the respective hydrogen halide for comparative purposes, although these could be in the form of the gaseous halide salt or the hydrogen halide—this assumption is made for consistency across all the graphs in Declaration B. As the graphs show trends between %Hg removal and halide content of the flue gas, so long as the amounts of the different halides present in the flue gas are compared in a consistent way it does not matter whether

they are in the form of the hydrogen halide or the halide ion in the flue gas for purposes of comparing relative %Hg removal.

The Office Action states that in order to establish that the method being used has unexpected results the components used must be the same for both methods. However, the data sets in the first and second plots at item 15 of Declaration B were taken from the table at item 10, which was produced using the same pilot-scale setup described at item 8, using the same components, the same type of AC, and the same method, with the only variations between the data sets being the type of treatment of the AC (i.e., AC treated with 5 wt% HCl outside the flue gas prior to injection into the flue gas, or placing NaCl on the coal and injection of untreated AC into the flue gas); item 15 of Declaration B has been revised to clarify this point.

I(E). Objective evidence of non-obviousness of the claimed invention.

Applicant herein discusses objective evidence of nonobviousnesss presented in Declaration A. The M.P.E.P. at §716.01(a) states that:

> Affidavits or declarations, when timely presented, containing evidence of criticality or unexpected results, commercial success, long-felt but unsolved needs, failure of others, skepticism of experts, etc., must be considered by the examiner in determining the issue of obviousness of claims for patentability under 35 U.S.C. 103.

The M.P.E.P. at §716.01(d) states that:

> When an applicant timely submits evidence traversing a rejection, the examiner must reconsider the patentability of the claimed invention. The ultimate determination of patentability must be based on consideration of the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any secondary evidence.

As explained in Declaration A at items 1-6, before the priority date of the presently claimed invention, the EPA called for new mercury removal technology in the 1990s, evidencing recognition of a problem and long-felt but unsolved needs that the presently claimed invention provides a solution for.

As explained in Declaration A at items 7-8, before the priority date of the presently claimed invention, the EPA espoused the conventional wisdom in favor of pre-treated sorbents, not in-flight

sorbent enhancement in the flue gas, evidencing a teaching away from the presently claimed invention by others.

As explained in Declaration A at items 9-11, before the priority date of the presently claimed invention, Sidney Nelson touted brominated sorbent, not in-flight sorbent enhancement in the flue gas, evidencing a teaching away from the presently claimed invention by others.

As explained in Declaration A at items 12-13, after the priority date of the presently claimed invention, the EPA continued to teach away from in-flight sorbent enhancement in the flue gas, evidencing a teaching away from the presently claimed invention by others and skepticism by experts that the presently claimed invention could provide effective and efficient mercury control.

As explained in Declaration A at items 14-15, before the priority date of the presently claimed invention, the Department of Energy funded research into in-flight sorbent enhancement in the flue gas, evidencing recognition of a problem and long-felt but unsolved needs that the presently claimed invention provides a solution for.

As explained in Declaration A at item 16, after the priority date of the presently claimed invention, in-flight sorbent enhancement in the flue gas was finally recognized as a critical advancement, evidencing praise by others for the presently claimed invention.

As explained in Declaration A at items 17-19, after the priority date of the presently claimed invention, in-flight sorbent enhancement in the flue gas experienced commercial success and was copied by Sidney Nelson and other competitors, evidencing copying of the presently claimed invention by others.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 1-3, 5-8, 14, and 21-26 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson.

II. The Office Action rejected claim 4 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed.

Claim 4 is presently canceled.

Further, as explained herein at **I**, independent claims 27, 54, and 55 are patentable over Felsvang and Nelson. Srinivasachar mentions treating activated carbon with halide salts or halogen acids prior to placing the activated carbon into flue gas. See, col. 6. lines 2-20. However, like Nelson, Srinivasachar fails to describe or suggest promotion of activated carbon in flue gas, and also fails to describe or suggest that HBr or Br^* have the same or greater effectiveness for mercury removal when used to treat activated carbons than chlorides. Accordingly, there would be no motivation for a person of ordinary skill in the art to use Srinivasachar's bromide additives in Felsvang's process. Further, there is no way to determine from Srinivasachar that in-flight promotion with bromide promoters is more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas (as explained herein at **I(B)(1)**), or that in-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride-promoters (as explained herein at **I(C)(1)**). Additionally, even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas as used in Nelson and Srinivasachar, they would not determine that in-flight promotion provides the same or better mercury removal properties, as explained herein at **I(D)**. As such, Srinivasachar fails to remedy the deficiencies of Felsvang and Nelson. Therefore, claims 27, 54, and 55 are patentable over Felsvang in view of Nelson and Srinivasachar.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 4 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson and Srinivasachar.

III. The Office Action rejected claim 9 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed.

Claim 9 is presently canceled.

Further, as explained herein at **I**, claims 27, 54, and 55 are patentable over Felsvang and Nelson. As explained herein at **II**, Srinivasachar fails to remedy the deficiencies of Felsvang and Nelson. Therefore, claims 27, 54, and 55 are patentable over Felsvang in view of Nelson and Srinivasachar.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 9 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson and Srinivasachar.

IV. The Office Action rejected claim 10 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,136,749 ("Gadkaree").

This rejection is respectfully traversed.

Claim 10 is presently canceled.

Further, as explained herein at **I**, claims 27, 54, and 55 are patentable over Felsvang and Nelson. Gadkaree mentions forming activated carbons in the presence of an alkali metal halide co-catalyst, see, claims 1 and 10. Gadkaree's Examples use KI or $SnCl_2$, and Gadkaree fails to describe or suggest relative mercury removal activities of activated carbons treated with bromide versus other halide additives. Gadkaree fails to describe or suggest promotion of activated carbon in flue gas, and does not even specifically mention bromide or bromine additives. Therefore, like Nelson, Gadkaree also fails to describe or suggest that HBr or $Br^{\cdot}$ have the same or greater effectiveness for mercury removal when used to treat activated carbons than chlorides. Accordingly, Gadkaree fails to remedy the deficiency of Nelson and Felsvang explained herein at **I(A)** that there would be no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process. Further, there is no way to determine from Gadkaree that in-flight promotion with bromide promoters is more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas (as explained herein at **I(B)(1)**), or that in-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride-promoters (as explained herein at **I(C)(1)**). Additionally, Gadkaree fails to remedy the deficiency of Nelson and Felsvang explained herein at **I(A)** that even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas as used in Nelson, they would not determine that in-flight promotion provides the same or better mercury removal properties. As such, Gadkaree fails to remedy the deficiencies of Felsvang and Nelson. Therefore, claims 27, 54, and 55 are patentable over Felsvang in view of Nelson and Gadkaree.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 10 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson and Gadkaree.

Double Patenting Rejection

V. Double patenting rejections.

V(A). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-30 of U.S. patent no. 7,435,286 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-30 of U.S. patent no. 7,435,286 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(B). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-25 of U.S. patent no. 8,168,147 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-25 of U.S. patent no. 8,168,147 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(C). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-60 of U.S. patent no. 8,512,655 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-60 of U.S. patent no. 8,512,655 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(D). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-60 of U.S. patent no. 8,821,819 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-60 of U.S. patent no. 8,821,819 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(E). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-33 of U.S. patent no. 9,757,689 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-33 of U.S. patent no. 9,757,689 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(F). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of U.S. patent no. 9,468,886 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of U.S. patent no. 9,468,886 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(G). The Office Action rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-30 of U.S. patent no. 8,652,235 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-30 of U.S. patent no. 8,652,235 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(H). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-16 of copending application no. 15/295,594 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-16 of copending application no. 15/295,594 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(I). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 8-20 of copending application no. 15/589,359.

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 8-20 of copending application no. 15/589,359.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(J). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/853,029 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of copending application no. 15/853,029 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(K). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 14/712,558.

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of copending application no. 14/712,558.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(L). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/951,970.

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of copending application no. 15/951,970.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(M). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/382,114 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of copending application no. 15/382,114 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(N). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/853,029 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of copending application no. 15/853,029 in view of Felsvang and Nelson. This rejection appears to be a duplicate of the rejection listed herein at **V(J)**.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

V(O). The Office Action provisionally rejected claims 1-10, 14, and 21-26 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/978,760 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-26 are obvious over claims 1-20 of copending application no. 15/978,760 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

CONCLUSION

It is respectfully submitted that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone the undersigned at (612) 349-9580 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402-0938
(612) 373-6900

Date July 10, 2019

By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

IN THE CLAIMS

Please amend the claims as follows:

1-26. (Canceled)

27. (New) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein

the coal comprises added Br_2, HBr, a bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises added Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;

contacting mercury in the mercury-containing gas with the sorbent; and

separating the sorbent contacted with the mercury from the mercury-containing gas.

28. (New) The method of claim 27, wherein the coal comprises the added Br_2, HBr, the bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber.

29. (New) The method of claim 27, wherein the combustion chamber comprises the added Br_2, HBr, the bromide compound, or a combination thereof.

30. (New) The method of claim 27, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the Br_2, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the Br_2, HBr, bromide compound, or combination thereof, to the coal is performed at the coal-combustion facility.

31. (New) The method of claim 27, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the Br_2, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the Br_2, HBr, bromide compound, or combination thereof, to the coal is performed at a site other than the coal-combustion facility.

32. (New) The method of claim 27, wherein the combustion chamber is an electric utility coal combustion chamber.

33. (New) The method of claim 27, wherein the combustion chamber is a coal combustion furnace.

34. (New) The method of claim 27, wherein the coal comprises a subbituminous coal.

35. (New) The method of claim 27, wherein the coal comprises a lignite coal.

36. (New) The method of claim 27, further comprising

measuring the mercury content of the mercury-containing gas; and

modifying, in response to the measured mercury content of the mercury-containing gas,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

37. (New) The method of claim 36, wherein the measuring of the mercury content comprises continuous measurement.

38. (New) The method of claim 27, further comprising:

modifying, in response to a measured mercury content,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

39. (New) The method of claim 27, wherein the mercury-containing gas comprises about 1 g to about 30 g of the element bromine per 100 g of the sorbent.

40. (New) The method of claim 27, wherein the sorbent contacted with the mercury comprises the element bromine and mercury.

41. (New) The method of claim 27, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas.

42. (New) The method of claim 27, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas with the sorbent.

43. (New) The method of claim 27, wherein the sorbent in the mercury-containing gas comprises about 1 g to about 30 g of the added Br_2, HBr, the bromide compound, or a combination thereof, per 100 g of the sorbent.

44. (New) The method of claim 27, wherein the Br_2, HBr, or the bromide compound is contacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.

45. (New) The method of claim 27, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.

46. (New) The method of claim 27, wherein the sorbent injected into the mercury-containing gas is a sorbent obtained by contacting a sorbent with a halogen or halide promoter prior to the injection of the sorbent into the mercury-containing gas.

47. (New) The method of claim 27, wherein the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.

48. (New) The method of claim 27, wherein the combustion chamber comprises a boiler.

49. (New) The method of claim 27, wherein the mercury-containing gas is a flue gas.

50. (New) The method of claim 27, wherein the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator, a scrubber, or a combination thereof.

51. (New) The method of claim 50, wherein the particulate separator comprises a baghouse, a an electrostatic precipitator, a fabric filter, or a combination thereof.

52. (New) The method of claim 27, wherein a halide sorbent enhancement additive comprises the added Br_2, HBr, bromide compound, or combination thereof.

53. (New) The method of claim 52, wherein the sorbent enhancement additive comprises the bromide compound.

54. (New) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br^-, or a combination thereof, wherein

the coal comprises added Br_2, HBr, a bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises added Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;

contacting mercury in the mercury-containing gas with the sorbent; and

separating the sorbent contacted with the mercury from the mercury-containing gas.

55. (New) A method of separating mercury from a mercury-containing gas, the method comprising:

combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br^-, or a combination thereof, wherein

the coal comprises added Br_2, HBr, a bromide compound, or a combination thereof, added to the coal before the coal enters the combustion chamber, or

the combustion chamber comprises added Br_2, HBr, a bromide compound, or a combination thereof, or

a combination thereof;

injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent;

contacting mercury in the mercury-containing gas with the promoted sorbent;

separating the promoted sorbent contacted with the mercury from the mercury-containing gas;

measuring the mercury content of the mercury-containing gas; and

modifying, in response to the measured mercury content,

an injection rate of injecting the sorbent into the mercury-containing gas,

an amount of the Br_2, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or

a combination thereof.

A/N 15/974,343 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/974,343 Group Art Unit: 1776
Filed: May 8, 2018 Docket No.: 4820.001US9
Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.116

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

Applicant has received the Final Office Action dated January 14, 2019. Please enter the following.

This response is accompanied by a Petition, as well as the appropriate fee, to obtain a three-month extension of the period for responding to the Office Action, thereby moving the deadline for response from April 14, 2019 to July 14, 2019.

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,343,114	7/9/2019	Olson, Edwin S, et al.
	US-20120100053A1	4/26/2012	Durham, Michael D, et al.
	US-20130157845A1	6/20/2013	Nalepa, Christopher J, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	WO-2012030560A1	3/8/2012	Nalepa, Christopher J, et al.	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 15/382,114, Final Office Action mailed 06-21-19", 31 pgs	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 06-21-19", 7 pgs	
	"Application Serial No. 15/978,760, Notice of Allowability mailed 05-30-19", 3 pgs	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Amber Orlando
Serial No.: 15/974,343	Group Art Unit: 1776
Filed: May 8, 2018	Docket: 4820.001US9
Customer No.: 21186	Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(b), it is believed that no fee or statement is required with the Information Disclosure Statement. However, if an Office Action on the merits has been mailed after filing of the application or after the filing of the most recent RCE, the Commissioner is hereby authorized to charge the required fees to Deposit Account No. 19-0743 in order to have this Information Disclosure Statement considered.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date July 10, 2019 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:mlr1

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL		
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Confirmation Number	1072
	Group Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9
	Customer No.	21186

This is a Request for Continued Examination (RCE) under 37 C.F.R § 1.114 of the above-identified application entitled SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

1. Submission required under 37 C.F.R. § 1.114:

   X Amendment and Response Under 37 C.F.R § 1.116 (81 pages) is enclosed.

   X Certification and Request for Prioritized Examination (Track 1) (1 pg)

   X Information Disclosure Statement (2 pages), Form 1449 (1 page), and copies of cited documents (4).

   X Petition for Extension of Time (1 pg).

   X DECLARATION UNDER 37 C.F.R. § 1.132 (A) (11 pgs), (B) (12 pgs), (C) (16 pgs), and (D) (6 pgs)

2. Fees

   X Authorization to charge deposit account 19-0743 in the amount of $1300.00 to pay the RCE filing fee required under 37 C.F.R. § 1.17(e).

   X Authorization to charge Deposit Account 19-0743 in the amount of $4000.00 for the Prioritized Examination (Track 1) filing fee as set forth in 37 C.F.R. § 1.17(c); and Authorization to charge Deposit Account 19-0743 for the Processing Fee (Track 1) set forth in 37 C.F.R. § 1.17(i) in the amount of $140.00.

   X Authorization to charge deposit account 19-0743 in the amount of $1400.00 to pay the extension of time fee.

   X Authorization to charge deposit account 19-0743 in the amount of $300.00 to cover the fee for additional claims.

The fee for additional claims has been calculated as follows:

CLAIMS AS AMENDED						
	Claims Remaining After Amendment		**Highest Number Previously Paid For**	**Present Extra**	Rate	**Fee**
TOTAL CLAIMS	29	-	26	3	x 100.00 =	300.00
INDEPENDENT CLAIMS	0	-	3	0	x 460.00 =	0.00
[] MULTIPLE DEPENDENT CLAIMS PRESENTED						0.00
TOTAL						300.00

The Commissioner is hereby authorized to charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.

/By Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

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(71) Applicant *(for all designated States except US)*: **ALBEMARLE CORPORATION** [US/US]; 451 Florida Street, Baton Rouge, LA 70801-1765 (US).

(72) Inventors; and

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(74) Agents: **HOEFLING, Marcy, M.** et al.; Albemarle Corporation, 451 Florida Street, Baton Rouge, LA 70801-1765 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

WO 2012/030560 A1

(54) Title: IMPROVED SORBENTS FOR REMOVING MERCURY FROM EMISSIONS PRODUCED DURING FUEL COMBUSTION

(57) Abstract: Activated carbon is rendered more thermally stable by exposure to a non- halogenated additive, and optionally to a halogen and/or a halogen-containing compound. Such treated carbon is suitable for use in mitigating the content of hazardous substances in flue gases, especially flue gases having a temperature within the range of from about 100 °C to about 420 °C.

IMPROVED SORBENTS FOR REMOVING MERCURY FROM EMISSIONS PRODUCED DURING FUEL COMBUSTION

BACKGROUND

[0001] It has become both desirable and necessary to reduce the hazardous substance content of industrial flue gasses. The hazardous substances can have a deleterious affect on the public health and the environment. Industry and government have been working to reduce the emissions of such substances with good progress being made. Special focus has been on flue gas from coal-fired boilers, such as that found in electric generation plants. Recent focus has also been on emissions from cement kilns. But there is more to do. Hazardous substances include particulates, e.g. fly ash, acid gases, e.g. SOx, NOx, as well as dioxins, furans, heavy metals and the like.

[0002] The methods used to mitigate the emission of hazardous substances depend on the nature of the hazardous substance, the minimum emission level sought, the volume of emitted gas to be treated per unit time and the cost of the mitigating method. Some hazardous substances lend themselves to removal from gaseous effluent by mechanical means, e.g. capture and removal with electrostatic precipitators (ESP), fabric filters (FF) or wet scrubbers. Other substances do not lend themselves to direct mechanical removal.

[0003] Hazardous gaseous substances that are present in a gaseous effluent present interesting challenges, given that direct mechanical removal of any specific gaseous component from a gas stream is problematic. However, it is known, and an industrial practice, to remove hazardous gaseous components from a gaseous effluent by dispersing a fine particulate adsorbent evenly in the effluent to contact and capture, in flight, the targeted gaseous component. This is followed by mechanical removal of the adsorbent with its adsorbate from the effluent vapor by ESP, FF or wet scrubbers. A highly efficacious adsorbent is carbon, e.g., cellulosic-based carbons and coal-based carbons in a form such as powdered activated carbon (PAC). Such PACs, for example, can be used with or without modification. Modified PACs may enhance capture of the target hazardous substance by enhancing adsorption efficiency. PAC modification is exemplified by US 4,427,630; US 5,179,058; US 6,514,907; US 6,953,494; US 2001/0002387; US 2006/0051270; and US 2007/0234902. Cellulosic-

based carbons include, without limitation, carbons derived from woody materials, coconut shell materials, or other vegetative materials. Coal-based PACs include, without limitation, carbons derived from peat, lignite, bituminous, anthracite, or other similar sources.

[0004] A problem with the use of carbons in industrial applications, is their unreliable thermal stability, that is, the lack of assurance that they are resistant to self-ignition. Self-ignition is especially problematic when the carbon is used in the treatment of warm or hot gaseous effluents or when packaged or collected in bulk amounts. For example, bulk PAC is encountered (i) when the PAC is packaged, such as in super-sacks or (ii) when formed as a filter cake in an FF unit or is collected in silos or hoppers associated with an ESP, TOXECON unit, and baghouse. Self-ignition results from unmitigated oxidation of the carbon and can lead to its smoldering or burning. Self-ignition is exacerbated by the carbon being warm or hot, as could be the case when used in treating coal-fired boiler effluents. If oxygen (air) is not denied to the oxidation site or if the site is not cooled, the heat from the initial oxidation will propagate until the carbon smolders or ignites. Such an ignition can be catastrophic. Utility plants are especially sensitive about self-ignition as smoldering or fire within the effluent line can cause a plant shut-down with widespread consequences to served customers.

[0005] Further information on PAC thermal stability can be found in US 6,843,831, "Process for the Purification of Flue Gas." Some carbons are more resistant to self-ignition than others. For example, in the US, the use of coal-derived PACs is often employed for utility flue gas treatment, in part because of the generally recognized good thermal stability of coal-derived PACs.

[0006] It would be advantageous if PACs of lesser thermal stability, such as those derived from certain cellulosic-based carbons could be modified to be more thermally stable so that the practitioner could enjoy the benefit of the excellent adsorption qualities of cellulosic-based carbons. It would also be advantageous to improve the thermal stability of certain coal-based PACs, such as, those that are lignite-based, since even these carbons have been associated with self-ignition and smoldering events.

THE INVENTION

[0007] This invention meets the above-described needs by providing an activated carbon that has been exposed to a non-halogenated additive comprising sulfur, sulfuric acid, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally to a halogen and/or a halogen-containing compound, and that has at least one of the following: (i) a temperature of initial energy release that is greater than the temperature of initial energy release for the same activated carbon without the exposure to the non-halogenated additive and, optionally, to the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon without the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon without the exposure. It is believed that any one or more of the qualities recited in (i), (ii) and (iii) is indicative of an enhancement of the thermal stability of an activated carbon exposed to one or more non-halogenated additives, and optionally to a halogen and/or a halogen-containing compound, according to this invention as compared to the same activated carbon without the exposure. This invention also relates to a process for enhancing the thermal stability of activated carbon. The process comprises exposing the activated carbon to a non-halogenated additive comprising sulfur, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally, to a halogen and/or a halogen-containing compound, at a temperature and for a time sufficient so that the exposed activated carbon has at least one of the following: (i) a temperature of initial energy release that is greater than the temperature of initial energy release for the same activated carbon without the exposure to the non-halogenated additive and, optionally to the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon without the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon without the exposure. This invention also relates

to a process for mitigating the atmospheric release of gaseous hazardous substances from flue gases containing such substances, the process comprising contacting the flue gas with activated carbon that has been exposed to a non-halogenated additive comprising sulfur, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally, to a halogen and/or a halogen-containing compound, and that has at least one of the following: (i) a temperature of initial energy release that is greater than the temperature of initial energy release for the same activated carbon without the exposure to the non-halogenated additive and, optionally to the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon without the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon without the exposure.

[0008] The activated carbons of this invention can be, as before noted, derived from both cellulosic-based and coal-based materials.

[0009] The production of activated cellulosic-based carbons, e.g., wood-based PACs, is well known and generally entails either a thermal activation or chemical activation process. For more details see, *Kirk-Othmer Encyclopedia of Chemical Technology*, 4th Edition, Volume 4, pages 1015-1037 (1992). The activated wood-based carbon can be produced from any woody material, such as sawdust, woodchips, coconut shell materials, or other vegetative materials. The production of activated coal-based carbons, e.g., lignite-based PACs, are produced by similar processes.

[0010] Activated cellulosic-based carbons are commercially available. For example, activated wood-based carbons can be obtained from MeadWestvaco Corporation, Specialty Chemical Division. Activated coal-based carbons are also commercially available. Activated lignite-based carbons can be obtained from Norit Americas, Inc., whilst activated bituminous-based carbons can be obtained from Calgon Corporation. Activated carbons can be characterized by their particle size distribution (D^{10}, D^{50} and D^{90}); average particle size; BET surface area; Iodine No.; total pore volume; pore volume distribution (macro/meso and micro pores); elemental analysis; moisture content; and ash speciation and content. Particularly useful activated carbons have one or more of the following characteristics:

Characteristic	General Range	Specific Range
D^{10}	1-10 μm	2-5 μm
D^{50}	5-35 μm	10-20 μm
D^{90}	20-100 μm	30-60 μm
Average Particle Size:	10-50 μm	5-25 μm
BET:	>300 m^2/g	>500 m^2/g
Iodine No.:	300-1200 mg/g	>600 mg/g
Total Pore Volume:	0.10-1.20 cc/g	0.15-0.8 cc/g
Macro/Meso Pore Volume:	0.05-0.70cc/g	0.05-0.40cc/g
Micro Pore Volume:	0.05-0.50 cc/g	0.10-0.40 cc/g
Ash Content:	0-15 wt%	<10 wt%
Moisture Content:	0-15 wt%	<5 wt%

[0011] A non-halogenated additive comprising sulfur, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde can be used in treating carbons in accordance with this invention.

[0012] The halogen and/or the halogen-containing compound optionally used in treating cellulosic-derived carbons in accordance with this invention can comprise bromine, chlorine, fluorine, iodine, ammonium bromide, other nitrogen-containing halogen salts, sodium bromide, calcium bromide, potassium bromine, other inorganic halides, etc.

[0013] The non-halogenated additive and, optionally, the halogen and/or halogen-containing compound treatment of the carbons can be affected by batch or continuous methods. A suitable batch process feeds the carbon to a tumble reactor/dryer whereupon it is mixed with the non-halogen compound. The non-halogen compound can be added as a crystalline material, dry powder, slurry or solution depending upon the physical and/or solubility properties of the non-halogen compound. Upon completion of the feed of non-halogen compound, the treated carbon material can be dried as needed, especially if its moisture content exceeds 5 wt% based on the total weight of the fed carbon. In one application, gaseous Br_2, at its boiling point temperature, is optionally fed to the reactor/dryer at an initial temperature of from about

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75 °C to about 82 °C. The reactor/dryer pressure is conveniently kept at around ambient pressure. The dryer is run in the tumble mode during and after the feed. The post-feed tumble period is from about 30 minutes to an hour. Quantitatively, the amount of Br_2 fed corresponds identically or nearly identically with the desired bromine content of self-ignition resistant carbon. For example, if a self-ignition resistant carbon having a bromine content of about 5 wt% is desired, then the amount of Br_2 fed is 5 parts Br_2 per 95 parts of treated carbon. The Br_2 feed rate is essentially uniform throughout the Br_2 feed period. After the post feed tumble period, the self-ignition resistant carbon is removed from the reactor/dryer to storage or packaging.

[0014] A suitable continuous process for treating carbon features a separate feed of non-halogenated additive, and optionally, the halogen and/or halogen-containing compound, and the carbon to a continuous reactor. The non-halogenated additive and the optional halogen and/or halogen-containing compound can be co-fed as well. The particulate carbon is conveniently transported to and through the continuous reactor by a gas such as air and/or nitrogen. To enhance mixing, a downstream eductor can be used to insure turbulent mixing. Quantitatively, the same proportions used as in the batch method are used in the continuous method.

[0015] In both the batch and continuous modes it may be preferable, depending upon the properties of the non-halogenated additive, to introduce the optional halogen and/or halogen-containing compound prior to introduction of the non-halogenated additive by methods described above.

[0016] In both the described batch and continuous methods, all of the optional halogen and/or halogen-containing compound is incorporated in the self-ignition resistant carbon material. Thus, it is convenient to refer to the amount of Br_2 in the self-ignition resistant carbon material by reference to the amounts of Br_2 and treated carbon fed to the reactor. A 5 kg feed of Br_2 and a 95 kg feed of treated will be deemed to have produced a gaseous bromine treated self-ignition resistant carbon material containing 5 wt% bromine. However, if a practitioner should desire to directly measure the incorporated bromine, such measure can be affected by Schöniger Combustion followed by silver nitrate titration.

[0017] The optional halogen and/or halogen-containing self-ignition resistant carbon material can contain from about 2 to about 20 wt% halogen, the wt% being based on the total weight of the self-ignition resistant carbon. A wt% halogen value within the

range of from about 5 to about 15 wt% is especially useful when treating flue gas from coal-fired boilers.

[0018] Several techniques exist for determining the thermal properties of materials. For example, one can determine (i) the temperature of initial energy release; (ii) the self-sustaining ignition temperature; and/or (iii) the early stage energy release values. For these determinations it is useful to have a Differential Scanning Calorimetry (DSC) trace of the heat flow values vs temperature (°C) of the treated and untreated activated cellulosic-based carbon samples as they are controllably heated. The DSC conditions can be as follows: the sample size is about 10 mg; the carrier gas is air at a flow rate of 100 ml/minute; the temperature ramp rate is 10 degrees centigrade/ minute from ambient temperature to 850 °C. The DSC can be run on a TA Instruments Thermal Analyst 5000 Controller with Model 2960 DSC/TGA module. The DSC traces created from the DSC test results can be analyzed with TA Instruments Universal Analysis Software, version 4.3.0.6. The sample can be dried thoroughly before being submitted to DSC testing. Thermal drying is acceptable, e.g., drying a 0.5 to 5.0 gram sample at a temperature of 110 °C for 1 hour. The values obtained from the DSC testing can be traced on a Heat Flow (watts/gram) versus Temperature (°C) graph.

[0019] The thermal stability of a substance can be assessed, e.g., via the temperature of initial energy release, a.k.a., the point of initial oxidation (PIO) of the substance. As used in this specification, including the claims, the PIO of compositions and/or sorbents of this invention is defined as the temperature at which the heat flow, as determined by DSC, has increased by 1.0 W/g with the baseline corrected to zero at 100 °C. PIO has been found to be a good predictor of thermal stability, especially when compared to values for PACs known to generally have suitable thermal stability, i.e. "benchmark carbons." One such a benchmark carbon is exemplified by the lignite coal derived PAC impregnated with NaBr marketed by Norit Americas, Inc., designated DARCO Hg-LH, which coated PAC has been found to have a PIO value of 343 °C.

[0020] Another thermal stability assessment method of comparison is the self-sustaining ignition temperature (SIT). The SIT is usually defined as the intersection of the baseline and the slope at the inflection point of the heat flow as a function of temperature curve. The inflection point can be determined using TA Instruments Universal Analysis Software. Generally, the inflection point is defined in differential calculus as a point on a curve at which the curvature changes sign. The curve changes

from being concave upwards (positive curvature) to concave downwards (negative curvature), or vice versa.

[0021] One final thermal stability assessment method involves determining the early stage energy release values by integration of the DSC trace between 125 °C to 425 °C and between 125 °C to 375 °C. The values from these two integrations are each compared against the same values obtained for PACs that are known to generally have suitable thermal stability, i.e. "benchmark carbons." Such a benchmark carbon is again exemplified by the lignite coal derived PAC designated as DARCO Hg-LH, which has been found to have an early stage energy release values (125 °C to 425 °C) of 1,378 joules/gram and 370 joules/gram for 125 °C to 375 °C.

EXAMPLES

[0022] The following examples, summarized in Table 1, are illustrative of the principles of this invention. It is understood that this invention is not limited to any one specific embodiment exemplified herein, whether in the examples or the remainder of this patent application. The general procedure used to prepare the samples comprised blending a solution of non-halogenated additive with activated carbon. Certain non-halogenated additives (e.g., elemental sulfur), due to their special handling and solubility properties, are more preferably blended as a dry powder with the carbon. The activated carbon mixture was dried overnight in a recirculating air oven to provide a treated carbon. The treated carbon was optionally brominated with elemental bromine according to the process disclosed in US 6953494 or blended with other halogen sources, such as sodium bromide, potassium bromide, calcium bromide, hydrogen bromide, and/or ammonium bromide.

Examples 1-56.

[0023] The following table lists PIO values for a series of samples. The PAC designations are as follows:

-DARCO Hg LH – commercially-available lignite-based powdered activated carbon treated with sodium bromide; particle size, avg. = 18.1 μm.

-TWPAC – thermally-activated wood-based powdered activated carbon, from MeadWestvaco; particle size = 15.4 μm; surface area = 756 m^2/g; pore diameter, avg. = 21.0 Å.

-CCN – activated coconut-based powdered activated carbon, from Jacobi; particle size, avg. = 20.7 μm.

-CWPAC – chemically-activated wood-based powdered activated carbon, from MeadWestvaco; particle size = 16.2 μm.

Table 1. Thermal Properties of Cellulosic PACs Treated with Non-Halogenated Additives and (Optionally) Sources of Halogen

Example	Activated Carbon	Treatment	PIO (°C)
1 (Comparative)	Lignite	DARCO Hg-LH	343
2 (Comparative)	TWPAC	None	266
3 (Comparative)	TWPAC	Br_2 (5%)	356
4 (Comparative)	TWPAC	HCl (3.5%)	310
5 (Comparative)	TWPAC	HNO3 (3.5%)	300
6	TWPAC	Sulfamic Acid (3%)	384
7	TWPAC	Sulfamic Acid (10%)	416
8	TWPAC	Sulfamic Acid (3%); Br_2 (5%)	392
9	TWPAC	Sulfamic Acid (1.5%); Br_2 (5%)	388
10	TWPAC	Sulfur (5%)	402
11	TWPAC	Sulfur (2.5%)	397
12	TWPAC	Sulfur (2.5%); Br_2 (5%)	376
13	TWPAC	Sulfur (1.2%); Br_2 (5%)	378
14	TWPAC	Sulfuric Acid (3%)	309
15	TWPAC	Sulfuric Acid (3%); Br_2 (5%)	386
16	TWPAC	Sulfuric Acid (1.5%); Br_2 (5%)	375
17	TWPAC	Boric Acid (5%)	338
18	TWPAC	Boric Acid (5%); Br_2 (5%)	411
19	TWPAC	Phosphoric Acid (5%)	373
20	TWPAC	Phosphoric Acid (5%); Br_2 (5%)	403
21	TWPAC	Ammonium Sulfate (5%)	399
22	TWPAC	Ammonium Sulfate (3.4%)	384
23	TWPAC	Ammonium Sulfate (5%); Br_2 (5%)	395
24	TWPAC	Urea (5%)	306
25	TWPAC	Urea (5%); Br_2 (5%)	377
26 (Comparative)	TWPAC	Br_2 (10%)	370
27	TWPAC	Sulfuric Acid (15%); Br_2 (10%)	413
28	TWPAC	Br_2 (10%); Sulfuric Acid (15%)	421
29 (Comparative)	TWPAC	NaBr (10%)	287
30 (Comparative)	TWPAC	NaBr (5%)	282
31	TWPAC	NaBr (5%); S (2.5%)	372
32	TWPAC	NaBr (5%); Ammonium Sulfate (1.2%)	363
33	TWPAC	NaBr (5%); Sulfamic Acid (5%)	392
34	TWPAC	NaBr (5%); Sulfamic Acid (1.5%)	358
35 (Comparative)	TWPAC	KBr (10%)	276
36 (Comparative)	TWPAC	KBr (5%)	270
37	TWPAC	KBr (5%); Sulfamic Acid (5%)	394
38	TWPAC	KBr (5%); Sulfamic Acid (1.5%)	343
39 (Comparative)	TWPAC	$CaBr_2$ (10%)	307
40 (Comparative)	TWPAC	$CaBr_2$ (5%)	347

Example	Activated Carbon	Treatment	PIO (°C)
41	TWPAC	$CaBr_2$ (5%); Sulfamic Acid (5%)	362
42	TWPAC	$CaBr_2$ (5%); Sulfamic Acid (1.5%)	320
43 (Comparative)	TWPAC	aq. HBr (10%)	305
44 (Comparative)	TWPAC	aq. HBr (5%)	338
45	TWPAC	aq. HBr (5%); Sulfamic Acid (5%)	390
46	TWPAC	aq. HBr (5%); Sulfamic Acid (1.5%)	335
47 (Comparative)	TWPAC	NH_4Br (10%)	398
48 (Comparative)	TWPAC	NH4Br (5%)	368
49	TWPAC	NH_4Br (5%); Sulfamic Acid (5%)	401
50	TWPAC	NH_4Br (5%); Sulfamic Acid (1.5%)	386
51 (Comparative)	CCN	None	320
52	CCN	Sulfamic Acid (5%)	430
53	CCN	Sulfamic Acid (5%); Br_2 (5%)	447
54	CCN	Sulfuric Acid (5%)	433
55	CCN	Sulfuric Acid (5%); Br_2 (5%)	417
56	CCN	Boric Acid	463
57	CCN	Boric Acid; Br_2 (5%)	455
58	CCN	Sulfur (2.5%)	438
59	CCN	Sulfur (5%)	441
60	CCN	Sulfur (2.5%); Br_2 (5%)	443
61 (Comparative)	CCN	NaBr (5%)	354
62 (Comparative)	CWPAC	None	353
63 (Comparative)	CWPAC	Br_2 (5%)	300
64	CWPAC	Boric Acid (5%)	371
65	CWPAC	Boric Acid (5%); Br_2 (5%)	353
66	CWPAC	Sulfamic Acid (5%)	389
67	CWPAC	Sulfamic Acid (5%); Br_2 (5%)	360
68	CWPAC	Phosphoric Acid (5%)	363
69	CWPAC	Phosphoric Acid (5%); Br_2 (5%)	342
70	CWPAC	Sulfur (5%)	378
71	CWPAC	Sulfur (2.5%)	375
72	CWPAC	Sulfur (2.5%(; Br_2 (5%)	342
73	Lignite	None	392
74	Lignite	Br_2 (5%)	358
75	Lignite	Boric Acid (5%)	452
76	Lignite	Boric Acid (5%); Br_2 (5%)	416
77	Lignite	Sulfamic Acid (5%)	421
78	Lignite	Sulfamic Acid (5%); Br_2 (5%)	382
79	Lignite	Phosphoric Acid (5%)	423
80	Lignite	Phosphoric Acid (5%); Br_2 (5%)	383
81	Lignite	Sulfur (5%)	410
82	Lignite	Sulfur (5%); Br_2 (5%)	398

[0024] The following data indicate that the processes of this invention not only improve the thermal properties of brominated and non-brominated activated carbons but also provide good mercury capture results as well. These data were obtained using the mercury capture device described in US 6953494.

Table 2. Mercury Capture Data for Treated PACs of Examples 2, 3, 8, 10, 12, 15, 18, 20, 23, 25, 26, 27, 28, 29, 30, 33, 36, 40, 47, 48

Brominated PAC	Mercury Capture, (%, Avg)
Example 2 (Comparative)	46
Example 3 (Comparative)	72
Example 8	75
Example 10	50
Example 12	77
Example 15	75
Example 18	76
Example 20	73
Example 23	70
Example 25	71
Example 26 (Comparative)	79
Example 27	76
Example 28	53
Example 29 (Comparative)	71
Example 30 (Comparative)	69
Example 33	59
Example 36 (Comparative)	61
Example 40 (Comparative)	68
Example 47 (Comparative)	74
Example 48 (Comparative)	69

[0025] It is to be understood that the reactants and components referred to by chemical name or formula anywhere in the specification or claims hereof, whether referred to in the singular or plural, are identified as they exist prior to being combined with or coming into contact with another substance referred to by chemical name or chemical type (e.g., another reactant, a solvent, or etc.). It matters not what chemical changes, transformations and/or reactions, if any, take place in the resulting combination or solution or reaction medium as such changes, transformations and/or reactions are the natural result of bringing the specified reactants and/or components together under the conditions called for pursuant to this disclosure. Thus the reactants

and components are identified as ingredients to be brought together in connection with performing a desired chemical reaction or in forming a combination to be used in conducting a desired reaction. Accordingly, even though the claims hereinafter may refer to substances, components and/or ingredients in the present tense ("comprises", "is", etc.), the reference is to the substance, component or ingredient as it existed at the time just before it was first contacted, combined, blended or mixed with one or more other substances, components and/or ingredients in accordance with the present disclosure. Whatever transformations, if any, which occur *in situ* as a reaction is conducted is what the claim is intended to cover. Thus the fact that a substance, component or ingredient may have lost its original identity through a chemical reaction or transformation during the course of contacting, combining, blending or mixing operations, if conducted in accordance with this disclosure and with the application of common sense and the ordinary skill of a chemist, is thus wholly immaterial for an accurate understanding and appreciation of the true meaning and substance of this disclosure and the claims thereof. As will be familiar to those skilled in the art, the terms "combined", "combining", and the like as used herein mean that the components that are "combined" or that one is "combining" are put into a container, e.g., a combustion chamber, a pipe, etc. with each other. Likewise a "combination" of components means the components having been put together in such a container.

[0026] While the present invention has been described in terms of one or more preferred embodiments, it is to be understood that other modifications may be made without departing from the scope of the invention, which is set forth in the claims below.

CLAIMS

What is claimed is:

1. An activated carbon that has been exposed to a non-halogenated additive comprising sulfur, sulfuric acid, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally to a halogen and/or a halogen-containing compound and that has at least one of the following: (i) a temperature of initial energy release that is greater than the temperature of initial energy release for the same activated carbon without exposure to the non-halogenated additive and, optionally to the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon without the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon without the exposure.

2. The activated carbon of claim 1 wherein the halogen and/or the halogen-containing compound comprises bromine, chlorine, fluorine, iodine, ammonium bromide, other nitrogen-containing halogen salts, or sodium bromide, potassium bromide, calcium bromide, or other inorganic bromide salts.

3. A process for enhancing the thermal stability of activated carbon, which process comprises exposing the activated carbon to a non-halogenated additive comprising sulfur, sulfuric acid, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally to a halogen and/or a halogen-containing compound at a temperature and for a time sufficient so that activated carbon that has been exposed to the non-halogenated additive and, optionally to the halogen and/or the halogen-containing compound has at least one of the following: (i) a temperature of initial energy release greater than the temperature of initial energy release for the same activated carbon prior to exposure to the non-halogenated additive

and, optionally to the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon prior to the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon prior to the exposure.

4. The process of claim 3 wherein the halogen and/or the halogen-containing compound comprises bromine, chlorine, fluorine, iodine, ammonium bromide, other nitrogen-containing halogen salts, or sodium bromide, potassium bromide, calcium bromide, or other inorganic bromide salts.

5. A non-halogenated additive comprising sulfur, sulfuric acid, sulfamic acid, boric acid, phosphoric acid, ammonium sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally a halogen and/or a halogen-containing compound exposed, activated carbon that contains from about 2 to about 20 wt% halogen and has at least one of the following: (i) a temperature of initial energy release that is greater than the temperature of initial energy release for the same activated carbon prior to exposure to the non-halogenated additive and, optionally the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon prior to the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon prior to the exposure.

6. The activated carbon of claim 5 wherein the halogen and/or the halogen-containing compound comprises bromine, chlorine, fluorine, iodine, ammonium bromide, other nitrogen-containing halogen salts, or sodium bromide, potassium bromide, calcium bromide or other inorganic bromide salts.

7. A process for mitigating the atmospheric release gaseous hazardous substances from flue gases containing such substances, the process comprising contacting the flue gas with an activated carbon that has been exposed to a non-halogenated additive comprising sulfur, sulfuric acid, sulfamic acid, boric acid, phosphoric acid, ammonium

sulfate, urea, ammonium sulfamate, monoammonium phosphate, diammonium phosphate, melamine, melamine phosphate, boric acid/borate combination, silica gel/sodium carbonate, or urea/formaldehyde and, optionally to a halogen and/or a halogen-containing compound and that has at least one of the following: (i) a temperature of initial energy release that is greater than the temperature of initial energy release for the same activated carbon prior to exposure to the non-halogenated additive and, optionally to the halogen and/or the halogen-containing compound; (ii) a self-sustaining ignition temperature that is greater than the self-sustaining ignition temperature for the same activated carbon prior to the exposure; or (iii) an early stage energy release value that is less than the early stage energy release value for the same activated carbon prior to the exposure.

8. The process of claim 7 wherein the flue gas has a temperature within the range of from about 100 °C to about 420 °C.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/048454

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01J20/20 B01D53/64 C01B31/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B01J B01D C01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 088 719 A (TAKEDA CHEMICAL INDUSTRIES LTD) 16 June 1982 (1982-06-16) cited in the application claims 1,5-9 page 1, line 51 - line 55 page 2, line 53 - line 57 examples 4-6 tables 3-5	1-8
X	GB 2 122 916 A (TAKEDA CHEMICAL INDUSTRIES LTD) 25 January 1984 (1984-01-25) claims 1-21 page 1, line 23 - line 24 page 2, line 23 - line 29	1-8

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 November 2011	23/11/2011

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/048454

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 261 709 A (ITOGA KIYOSHI ET AL) 14 April 1981 (1981-04-14) claims 1,4 table 2 column 3, line 28 - line 44	1-8
X	US 2005/019240 A1 (LU XIAO-CHUN [US] ET AL) 27 January 2005 (2005-01-27) claims 1,2,7,8 examples 4,8 figures 14,15	1-8
X	EP 1 987 873 A2 (RWE POWER AG [DE]) 5 November 2008 (2008-11-05) claims 1-7 figure 1 examples 2,3	1-8
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2

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

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Page 409

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/048454

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Janal M. Kalis/Megan Reed
Attorney Docket Number:	4820.001US9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	3	100	300
Miscellaneous-Filing:				
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with $0 paid	1253	1	1400	1400
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1300	1300
		Total in USD ($)		**7140**

Electronic Acknowledgement Receipt

EFS ID:	36548280
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Janal M. Kalis/Megan Reed
Filer Authorized By:	Janal M. Kalis
Attorney Docket Number:	4820.001US9
Receipt Date:	10-JUL-2019
Filing Date:	08-MAY-2018
Time Stamp:	17:21:14
Application Type:	Utility under 35 USC 111(a)

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Payment Type	DA
Payment was successfully received in RAM	$7140
RAM confirmation Number	071119INTEFSW00004415190743
Deposit Account	190743
Authorized User	Megan Reed

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37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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		SIGNED_4820_001US9_RCE_Resp_IDS_Track1_Ext_Dec2.pdf	6934940 bf53d274898945dd1cc054c074a73dcc2f3015d5	yes	132

Multipart Description/PDF files in .zip description

Document Description	Start	End
Affidavit-traversing rejectns or objectns rule 132	127	132
Affidavit-traversing rejectns or objectns rule 132	111	126
Affidavit-traversing rejectns or objectns rule 132	99	110
Affidavit-traversing rejectns or objectns rule 132	88	98
Extension of Time	87	87
Information Disclosure Statement (IDS) Form (SB08)	86	86
Transmittal Letter	84	85
TrackOne Request	83	83
Applicant Arguments/Remarks Made in an Amendment	8	82
Claims	3	7
Amendment Submitted/Entered with Filing of CPA/RCE	2	2
Request for Continued Examination (RCE)	1	1

Warnings:

Information:

2	Non Patent Literature	4820003US2_OARN_06212019.pdf	725411 bd02af29f6306336834867dff822a1685fe6a782	no	7

Warnings:					
Information:					
3	Non Patent Literature	4820004US1_FOAR_06212019.pdf	3420798 ce5f3b2af5af470b21fbbe0f2a7f662db53c2c0f	no	31
Warnings:					
Information:					
4	Non Patent Literature	4820007US4_NALL_05302019.pdf	405171 69a3d81f98e358e2bb1500dcae1b5b04c1fca0ec	no	3
Warnings:					
Information:					
5	Foreign Reference	WO_2012030560_A1.pdf	2254578 e6ec792da1cb5fa7c2bfaf0e135da52594f23efc	no	19
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	39166 3790e29e72718d3843fdf0252374384cb478c1d9	no	2
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		Total Files Size (in bytes):	13780064		

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/978,760 Group Art Unit: 1776
Filed: May 14, 2018 Docket No.: 4820.007US4
Confirmation No.: 6432
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

DECLARATION D

I, John Pavlish, declare and say as follows:

1. I have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competitiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and

technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

2. Declaration B at item 8 describes that a pilot-scale 550,000-Btu/hr pulverized coal (pc)-fired test unit was used to combust subbituminous coal and test mercury control using various sorbents. The coal combustion flue gas exiting the pilot unit was cooled down to a nominal temperature of 149°C (300°F) and then was introduced into a single wire tubular ESP unit. Activated carbon sorbents were fed with a K-Tron dual-screw feeder upstream of the ESP. The feeder was calibrated prior to the start of each carbon injection test. No scrubber was used. Before Hg control testing began, a baseline condition was established with the pilot-scale unit, and flue gas mercury content was measured before each test as about 6-10 $\mu g/m^3$. The flue gas HCl concentration, with no additives on the coal, as calculated by the chlorine measured in the coal, was 2-5 ppm.

3. U.S. patent publication no. 2004/0003716 ("Nelson") describes treatment of activated carbon outside the flue gas with hydrogen bromide (HBr), and describes testing to measure the percent mercury removal when the treated activated carbon was injected into either simulated or actual flue gas at various injection rates. Specifically, Nelson performed experiments in Example 5 (paragraphs [0082]-[0085]) and 7 (paragraphs [0089]-[0092]), and provides the data in FIG. 14 and FIG. 15.

4. In Example 5, Nelson treated Norit DARCO® FGD with gaseous HBr, and tested its use by injecting the HBr-treated sorbent into a simulated coal-fired flue-gas stream in a pilot-scale test system. Nelson's FIG. 14 shows data for one activated carbon sample treated with HBr. The activated carbon had 10 wt% HBr, and at a sorbent injection rate of about 3.7 lb/MMacf gave a mercury removal of about 82%. As reported in paragraph [0082] of Nelson, duct-injection runs were performed with a simulated coal-fired flue-gas

stream on a 50-acfm pilot-scale test system. As described, the mercury mass transfer to fluidized sorbent and adsorption kinetics in this system were similar to that in a full-scale utility application. The fully-instrumented duct-injection test system that was used included a propane burner unit to generate the hot flue gas; a humidification drum to add an appropriate degree of moisture to the gas; an elemental mercury spiking subsystem with elemental mercury permeation tubes; a flue gas spiking subsystem with mass flow controllers for SO_2, NO_x, and HCl; a small sorbent feeder and fluidizing injection subsystem to lessen sorbent pulsing; 10 meters of insulated, 10-cm-diameter ducting circling the ceiling; thermocouples; an electrostatic filter with an effective specific collection area (SCA) of about 500 ft^2/Kacf; a back-up fabric filter; a safety filter; an orifice plate to measure flow; and a variable-speed I.D. fan. The gas temperature at injection was about 175 °C and at the electrostatic precipitator (ESP) was about 145 °C and the spiked flue gas concentrations were about 24 $\mu g/Nm^3$ Hg(0), 1400 ppm SO_2 , 600 ppm NO_x, and 5 ppm HCl, typical values for coal-fired power plants.

5. In Example 7, Nelson treated Norit DARCO® FGD with gaseous HBr, and tested its use in a coal-fired power plant by injecting the treated sorbent into the flue gas prior to the electrostatic precipitator (ESP). Nelson's FIG. 15 shows data for two activated carbon samples treated with HBr. The two activated carbon samples contained 9 wt% HBr. The data in FIG. 15 for the two HBr-treated sorbents show that at a sorbent injection rate of about 2.2 lb/MMacf, 45% of the mercury was removed, and at a sobent injection rate of about 4.2 lb/MMacf, 62% of the mercury was removed. As reported in paragraphs [0089]-[0091] of Nelson, a large-scale duct-injection trial was performed at the 18-MW scale, with about 60,000 acfm of flue gas at 160 °C (320 °F). The plant had stoker-fed boilers, burned a high-sulfur bituminous coal, and had just a cold-side ESP for emission control. Baseline sampling according to the Ontario Hydro Method indicated no intrinsic mercury removal of mercury across the ESP. Without sorbent injection, the plant emitted about 10 $\mu g/Nm^3$ of mercury from the stack, with 80 to 90% of this in oxidized forms. In these trials, the mercury was measured using a speciating PS Analytical Sir Galahad continuous mercury monitor. Inlet mercury values were obtained

by sampling upstream of the sorbent injection point and outlet mercury was measured at the stack. The sorbents were injected into ductwork through a lance to mix with the flue gases about 40 feet from the entrance to the ESP. The flue gas contained about 1000 ppm of SO_2, 20 ppm of SO_3, 250 ppm of NO_x, and 25 ppm of HCl. The ESP had an SCA of 370 ft^2/Kacfm.

6. Nelson's Examples 5 and 7 do not describe the use of a scrubber. Example 7 of Nelson uses only a cold-side ESP for emission control, with injection of the activated carbon upstream of the ESP. Example 5 of Nelson describes an ESP that occurs after the point of injection and that has a temperature of 145 °C (293 °F) at the inlet, also corresponding to a cold-side ESP. Similarly, in the pilot-scale setup described at item 8 of Declaration B no scrubber was used, and activated carbon was injected upstream of the ESP. These similarities between Nelson's Example 5 and 7 and the pilot-scale setup described at item 8 of Declaration B allow for good comparison with the Nelson data.

7. Nelson's Example 5 describes a flue gas HCl concentration of 5 ppm, which is similar to the flue gas HCl concentration in the pilot-scale setup described at item 8 of Declaration B, allowing for good comparison between Nelson's Example 5 and the pilot-scale setup described at item 8 of Declaration B. However, Nelson's Example 7 describes a flue gas HCl concentration of 25 ppm. The higher HCl concentration in Nelson's Example 7 flue gas allows for easier mercury removal, due to HCl acting as a promotor of the activated carbon, as compared to the pilot-scale setup described at item 8 of Declaration B.

8. The mercury concentration of the flue gas from the pilot-scale setup described at item 8 of Declaration B was in the range of 6-10 $\mu g/m^3$, as compared to Nelson's Example 5 data for which the mercury concentration of the flue gas is about 24 $\mu g/m^3$. The higher mercury concentration in Nelson's Example 5 allows for easier mercury removal as the mercury concentration at the point of activated carbon injection is much higher. To illustrate this, to remove 70% of the mercury from Nelson's Example 5 setup,

the mercury concentration leaving the ESP after the mercury is captured by the treated activated carbon would be: 24 - (24*70/100) = 7.2 $\mu g/m^3$. To remove 70% of the mercury from the pilot-scale setup described at item 8 of Declaration B, the mercury concentration leaving the ESP after the mercury is captured by the activated carbon would be: 8 - (8*70/100) = 2.4 $\mu g/m^3$. When mercury concentration is lower, the probability of activated carbon sorbent particles contacting mercury in the flue gas is lower, and the overall number of encounters between activated carbon particles and mercury atoms or compounds per time is lower; therefore, the activated carbon sorbent particles must be more adsorptive (e.g., reactive) toward mercury in order to remove mercury at low concentrations as compared to the same activated carbon sorbent placed in a higher concentration of mercury. As the calculation shows, it is more difficult to remove the same percentage of mercury from the flue gas starting with a lower concentration of 8 $\mu g/m^3$ than starting at a higher concentration of 24 $\mu g/m^3$.

9. As explained at item 6, Nelson's experimental setup in Examples 5 and 7 and the experimental setup described at item 8 of Declaration B inject activated carbon sorbent into a flue gas upstream of an ESP and use no scrubber, making the procedures comparable. However, as explained at item 7, the higher HCl concentration in Nelson's Example 7 flue gas allows for easier mercury removal, due to HCl acting as a promotor of the activated carbon, as compared to the pilot-scale setup described at item 8 of Declaration B. Further, as explained at item 8, the higher mercury concentration in Nelson's Example 5 makes it easier for Nelson's sorbents to remove the same overall percentage of mercury from the flue gas, as compared to the pilot-scale setup described at item 8 of Declaration B. Therefore, if Nelson's Example 5 and 7 HCl and mercury concentrations were changed to match those of the pilot-scale setup described at item 8 of Declaration B, Nelson's sorbents would remove a lower percentage of mercury than found in Nelson's Examples 5 and 7.

10. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and/or any patent issued thereon.

Dated: March 20, 2019

By: / John Pavlish /

John Pavlish

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/978,760 Group Art Unit: 1776
Filed: May 14, 2018 Docket No.: 4820.007US4
Confirmation No.: 6432
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

DECLARATION C

We, John Pavlish and Nicholas Lentz, declare and say as follows:

1. I, John Pavlish, have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competitiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and

technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

2. I, Dr. Nicholas Lentz, Field Technical Manager for Midwest Energy Emissions Corporation, have more than 10 years of experience conducting mercury research and tests, both in the lab and in the field with over 30 full-scale mercury test programs and also numerous bench- and pilot-test projects. I am also an expert in the identification and development of new analytical methods for the advancement of elemental and small molecule analysis in a wide range of matrices including coal and coal by-products, CO_2 capture solutions, oil and gas fuels; analysis for combustion flue gas, syngas, fuel oil, and biowaste. Prior to my current position, I was an Associate Director for Energy Technology Applications in the Institute for Energy Studies at the University of North Dakota. I also previously was a Center for Air Toxic Metals (CATM) Program Area Manager and Research Scientist at the Energy & Environmental Research Center where I was responsible for managing a portfolio of measurement-based research projects in the Analytical Measurement Area of CATM as well as experimental design and analysis related control technologies to remove mercury, trace metals, and halogens from combustion and gasification systems. I have a B.S. in Chemistry from Bemidji State University and Ph.D. in Analytical Chemistry from Iowa State University. I have authored and co-authored numerous publications.

3. All websites referenced in this document were accessed 3/15/2019.

4. Merriam-Webster dictionary defines "bromine" as "a nonmetallic halogen element that is isolated as a deep red corrosive toxic volatile liquid of disagreeable odor. See, https://www.merriam-webster.com/dictionary/bromine. Wikipedia defines "bromine" as "...a chemical element with symbol Br and atomic number 35. It is the

third-lightest halogen, and is a fuming red-brown liquid at room temperature that evaporates readily to form a similarly coloured gas." See, https://en.wikipedia.org/wiki/Bromine. Dictionary.com defines "bromine" as "an element that is a dark-reddish, fuming, toxic liquid and a member of the halogen family: obtained from natural brines and ocean water, and used chiefly in the manufacture of gasoline antiknock compounds, pharmaceuticals, and dyes. Symbol: Br; atomic weight: 79.909; atomic number: 35 ..." See, https://www.dictionary.com/browse/bromine.

5. Merriam-Webster dictionary defines "chlorine" as "a halogen element that is isolated as a heavy greenish-yellow diatomic gas of pungent odor and is used especially as a bleach, oxidizing agent, and disinfectant in water purification." See, https://www.merriam-webster.com/dictionary/chlorine. Wikipedia defines "chlorine" as "...a chemical element with symbol Cl and atomic number 17. The second-lightest of the halogens, it appears between fluorine and bromine in the periodic table and its properties are mostly intermediate between them. Chlorine is a yellow-green gas at room temperature." See, https://en.wikipedia.org/wiki/Chlorine. Dictionary.com defines "chlorine" as "a halogen element, a heavy, greenish-yellow, incombustible, water-soluble, poisonous gas that is highly irritating to the respiratory organs, obtained chiefly by electrolysis of sodium chloride brine: used for water purification, in the making of bleaching powder, and in the manufacture both of chemicals that do not contain chlorine, as ethylene glycol, and of those that do. Symbol: Cl; atomic weight: 35.453; atomic number: 17." See, https://www.dictionary.com/browse/chlorine.

6. Encyclopedia Britannica online states that "[a]t room temperature and atmospheric pressure the halogen elements in their free states exist as diatomic molecules." https://www.britannica.com/science/halogen-element. The Chemistry LibreTexts Library states that "[h]alogens form diatomic molecules (of the form X_2, where X denotes a halogen atom) in their elemental states. The bonds in these diatomic molecules are non-polar covalent single bonds" See, https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_(I

norganic_Chemistry)/Descriptive_Chemistry/Elements_Organized_by_Block/2_p-Block_Elements/Group_17%3A_The_Halogens/0Group_17%3A_Physical_Properties_of_the_Halogens/Group_17%3A_General_Properties_of_Halogens. ThoughtCo.com states that "[h]alogens range from solid (I_2) to liquid (Br_2) to gaseous (F_2 and Cl_2) at room temperature. As pure elements, they form diatomic molecules with atoms joined by nonpolar covalent bonds." See, https://www.thoughtco.com/halogen-elements-and-properties-606650.

7. Sigma-Aldrich gives the properties of elemental bromine, Br_2 as including a molecular weight of 159.81 g/mol, a boiling point of 58.8 °C, and a melting point of -7.2 °C. See, https://www.sigmaaldrich.com/catalog/product/sigald/207888?lang=en&region=US.

8. Sigma-Aldrich gives the properties of Cl_2 as including a molecular weight of 70.91 g/mol, a boiling point of -34 °C, and a melting point of -101 °C. See, https://www.sigmaaldrich.com/catalog/product/aldrich/295132?lang=en&region=US.

9. Merriam-Webster dictionary defines "bromide" as "1: a binary compound of bromine with another element or a radical including some (such as potassium bromide) used as sedatives." See, https://www.merriam-webster.com/dictionary/bromide. Wikipedia defines "bromide" as "...a chemical compound containing a bromide ion or ligand. This is a bromine atom with an ionic charge of -1 (Br^-); for example, in caesium bromide, caesium cations (Cs^+) are electrically attracted to bromide anions (Br^-) to form the electrically neutral ionic compound CsBr. The term "bromide" can also refer to a bromine atom with an oxidation number of -1 in covalent compounds such as sulfur dibromide (SBr_2)." See, https://en.wikipedia.org/wiki/Bromide. Dictionary.com defines "bromide" as "1. A salt of hydrobromic acid consisting of two elements, one of which is bromine, as sodium bromide, NaBr; 2. A compound containing bromine, as methyl bromide." See, https://www.dictionary.com/browse/bromide.

10. Merriam-Webster dictionary defines "chloride" as "1: a compound of chlorine with another element or group especially :a salt or ester of hydrochloric acid; 2: a monovalent anion consisting of one atom of chlorine." See, https://www.merriam-webster.com/dictionary/chloride. Wikipedia defines "chloride" as "...a compound of chlorine with a salt or ester of hydrochloric acid" and as "...the anion (negatively charged ion) Cl^-." See, https://en.wikipedia.org/wiki/Chloride_(disambiguation) and https://en.wikipedia.org/wiki/Chloride. Dictionary.com defines "chloride" as "1. A salt of hydrochloric acid consisting of two elements, one of which is chlorine, as sodium chloride, NaCl; 2. A compound containing chlorine, as methyl chloride, CH_3Cl." See, https://www.dictionary.com/browse/chloride.

11. Wikipedia defines "hydrogen halides" as "... diatomic inorganic compounds with the formula HX where X is one of the halogens: fluorine, chlorine, bromine, iodine, or astatine. ... Hydrogen halides are gases that dissolve in water to give acids which are commonly known as hydrohalic acids. The direct reaction of hydrogen with fluorine and chlorine gives hydrogen fluoride and hydrogen chloride, respectively. Industrially these gases are, however, produced by treatment of halide salts with sulfuric acid. Hydrogen bromide arises when hydrogen and bromine are combined at high temperatures in the presence of a platinum catalyst. The least stable hydrogen halide, HI, is produced less directly, by the reaction of iodine with hydrogen sulfide or with hydrazine." See, https://en.wikipedia.org/wiki/Hydrogen_halide.

12. Merriam-Webster defines "hydrogen bromide" "a colorless irritating gas HBr that fumes in moist air and yields hydrobromic acid when dissolved in water." See, https://www.merriam-webster.com/dictionary/hydrogen%20bromide. Dictionary.com defines "hydrogen bromide" as "a colorless gas, HBr, having a pungent odor: the anhydride of hydrobromic acid." See, https://www.dictionary.com/browse/hydrogen-bromide. Wikipedia defines "hydrogen bromide" as "...the diatomic molecule with the formula HBr. It is a colorless compound and a hydrogen halide. Hydrobromic acid is a solution of HBr in water. Both the anhydrous and aqueous solutions of HBr are common

reagents in the preparation of bromide compounds. ...Hydrogen bromide (along with hydrobromic acid) is produced by combining hydrogen and bromine at temperatures between 200 and 400 °C. The reaction is typically catalyzed by platinum or asbestos."

13. Merriam-Webster defines "hydrogen chloride" as "a colorless pungent poisonous gas HCl that fumes in moist air and yields hydrochloric acid when dissolved in water." See, https://www.merriam-webster.com/dictionary/hydrogen%20chloride. Dictionary.com "hydrogen chloride" "a colorless gas, HCl, having a pungent odor: the anhydride of hydrochloric acid." Wikipedia defines "hydrogen chloride" as "[t]he compound hydrogen chloride has the chemical formula HCl and as such is a hydrogen halide. At room temperature, it is a colorless gas, which forms white fumes of hydrochloric acid upon contact with atmospheric water vapor. Hydrogen chloride gas and hydrochloric acid are important in technology and industry. Hydrochloric acid, the aqueous solution of hydrogen chloride, is also commonly given the formula HCl. ...pure chlorine gas can be combined with hydrogen to produce hydrogen chloride in the presence of UV light: $Cl_2(g) + H_2(g) \longrightarrow 2\ HCl(g)$."

14. Sigma-Aldrich gives the properties of HBr as including a molecular weight of 80.91 g/mol, a boiling point of -67 °C, and a melting point of -87 °C. See, https://www.sigmaaldrich.com/catalog/product/aldrich/295418?lang=en&region=US.

15. Sigma-Aldrich gives the properties of HCl as including a molecular weight of 36.46 g/mol, a boiling point of -85 °C, and melting point of -114 °C. See, https://www.sigmaaldrich.com/catalog/product/aldrich/295426?lang=en&region=US.

16. Wikipedia defines the "octet rule" as "... a chemical rule of thumb that reflects observation that atoms of main-group elements tend to combine in such a way that each atom has eight electrons in its valence shell, giving it the same electron configuration as a noble gas. The rule is especially applicable to carbon, nitrogen, oxygen, and the

halogens, but also to metals such as sodium or magnesium." See, https://en.wikipedia.org/wiki/Octet_rule.

17. As shown by items 3-16 herein, hydrogen halides are diatomic molecules including a halogen atom and a hydrogen atom; in contrast, elemental halogens are diatomic molecules including two of the same halogen atom. HBr and HCl each include a hydrogen atom and one halogen atom, while Br_2 and Cl_2 each include two halogen atoms. Hydrogen halides have different properties than elemental halogens and are therefore different compounds. HBr has a molecular weight of 80.91 g/mol, while Br_2 has a molecular weight of 159.81 g/mol; HBr has a boiling point of -67 °C, while Br_2 has a boiling point of 58.8 °C; HBr has a melting point of -87 °C, while Br_2 has a melting point of -7.2 °C. HCl has a molecular weight of 36.46 g/mol, while Cl_2 has a molecular weight of 70.91 g/mol; HCl has a boiling point of -85 °C, while Cl_2 has a boiling point of 70.91 g/mol; HCl has a melting point of -114 °C, while Cl_2 has a melting point of -101 °C. Hydrogen halides are not part of and cannot be extracted or isolated from elemental halides; rather, only via a chemical reaction that results in a chemical and structural change can hydrogen halides be formed from elemental halides. Hydrogen bromide is produced by reacting hydrogen and Br_2 at about 200-400 °C, a reaction that is typically catalyzed by platinum or asbestos. Hydrogen chloride is produced by reacting hydrogen and chlorine with one another. Therefore, elemental halogens are not hydrogen halides, and do not include hydrogen halides—Br_2 is not HBr and does not include HBr, and Cl_2 is not HCl and does not include HCl.

18. As shown by items 3-16 herein, chlorine has an atomic number of 17, meaning it has 17 protons and 17 electrons, giving it an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^5$, having 7 electrons in its outer shell. Bromine has an atomic number of 35, meaning it has 35 protons and 35 electrons, giving it an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$, also having 7 electrons in its outer shell. According to the octet rule, a halogen atom desires to fill its outer shell with 8 electrons total by gaining one electron. A halide ion is a halogen atom that has accepted an electron from an

electron doner, in the case of chloride giving it 18 total electrons to give a total charge of -1, and in the case of bromide giving it 36 total electrons to give a total charge of -1. Halogen atoms do not donate electrons to other atoms, because this would result in a halogen atom losing an electron to have 6 electrons in its outer shell, an unstable configuration according to the octet rule. In the case of an elemental halogen, which exists as a diatomic molecule, instead of donating electrons to one another, each halogen atom shares one of its electrons in the outer shell with the other halogen atom via overlapping electron orbitals in a covalent bond, allowing each halogen atom to have a filled octet while the diatomic molecule remains neutrally charged. Therefore, a halogen atom does not donate electrons to another halogen atom to form a halide, and a diatomic halogen molecule never includes a halide; Br_2 is not and does not include Br^-, and Cl_2 is not and does not include Cl^-.

19. As described in the paper "Effect of HBr formation on mercury oxidation via $CaBr_2$ addition to coal during combustion", Y. Yang et al., RSC Adv., 2016, 6, 59009-59015 ("Yang"), in a bench-scale simulated coal-fired power plant, $CaBr_2$ was added in various concentrations to three different types of coal that were combusted and the concentration of HBr and Br_2 in the released combustion gases were analyzed by quantitative gas analysis mass spectrometry. See, Yang at Sections 2.1-2.2. Section 3.4 states at page 59012 bridging to page 59013 that "[t]he results confirmed the generation of HBr in coal-fired flue gas due to the $CaBr_2$ additive in coal, but Br_2 was not detected." Near the end of Section 3.4 at page 59013 Yang states that "[t]he HBr concentration in flue gas increased with increasing amounts of $CaBr_2$ additive..." At the top of the right column on page 59013, Yang proposes the following formula for the generation of HBr from $CaBr_2$: $CaBr_2 + H_2O \rightarrow CaO + HBr$, stating at page 59013 from the left column bridging to the right column that the water is generated by hydrogen-containing organisms in coal during combustion via $C_nH_mOH + O_2 \rightarrow H_2O + CO_2$.

20. As described in the paper "Mercury control evaluation of calcium bromide injection into a PRB-fired furnace with an SCR", M. Berry, Proceedings of the Air

Quality VI Conference, Arlington, VA, 2007 ("Berry"), a $CaBr_2$ was injected at various concentrations into the furnace of a full-scale coal-fired power plant and the concentration of HBr in the released combustion gases were analyzed at the ESP inlet and at the ESP outlet. Berry found that HBr content increased with increasing calcium bromide injection. See, Berry at page 5, top two paragraphs and Figure 3.

21. As described in the book "Coal Combustion Products (CCPs) Characteristics, Utilization, and Beneficiation", T. Robl et al., Woodhead Publishing, 2017, ("Robl"), at page 91, last full paragraph and last partial paragraph:

> As described previously, eastern coals with a higher chlorine content produce mostly oxidized mercury in their flue gases, while western coals, such as PRB coals, that have a low chlorine content tend to produce mostly elemental mercury. ...
>
> Halogen salts such as calcium chloride ($CaCl_2$), calcium bromide ($CaBr_2$), or potassium iodide (KI) can be added to the coal as a means of supplementing the coal chlorine content. Salts added with the coal or injected into the furnace decompose at furnace temperatures to form vapor-phase acids (HCl, hydrogen bromide (HBr), or hydrogen iodide (HI)) in the flue gas.

22. Typical temperatures in a coal-combustion furnace range from 2,400-4,200 °F, with internal flame temperatures reaching 4,000-4,200 °F or higher. Table 1 lists select halide salt boiling points. Coal-combustion furnace temperatures are higher than the boiling points of halide salts such as NaBr and $CaBr_2$. Thus, the conditions and environment inside the furnace/boiler are adequate for boiling of halide salts (whether in a solid state, in a liquid solution, or as part of the coal) to form gaseous molecules.

Table 1. Common Halide Salt Boiling Points.[1]

Compound	Boiling point, °F
NaBr	2,534
NaCl	2,669
NaI	2,379
$CaCl_2$	3,516
$CaBr_2$	3,299
CaI	2,012
NH_4Br	745
NH_4Cl	640
NH_4I	761

23. The FactSage program (see, http://www.factsage.com/) is one of the largest fully integrated database computing systems for chemical thermodynamics calculations. The FactSage program is a series of information, database, calculation, and manipulation modules that access databases containing properties of materials. The FactSage program can calculate the conditions for multiphase, multicomponent equilibria, with a wide variety of tabular and graphical output modes, under a large range of constraints. Equilibrium calculations performed by the FactSage program can be used to determine equilibrium molecular decomposition states as a function of temperature. These thermodynamic models can be used to predict the chemical species that will be present to react with other molecules present in the flue gas at the same time, such as radicals, ionic compounds, elemental forms of chemical elements, and the like. FactSage was used to calculate equilibrium concentrations of materials present for a 100 g solid NaBr sample in a coal-combustion furnace as a function of temperature, shown in Figure 1. Figure 1 clearly shows the rapid emergence of gaseous NaBr molecules once the NaBr boiling point of 2,530 °F is reached. At temperatures of around 3,000 °F, nearly all the solid NaBr has been converted to gas phase NaBr molecules. As the gas phase NaBr molecules are brought to temperatures beyond 3,000 °F, dissociation into gaseous sodium atoms and bromine atoms occurs.

[1] Lide, D.R., 1995, CRC handbook of chemistry and physics: a ready-reference book of chemical and physical data, CRC press.

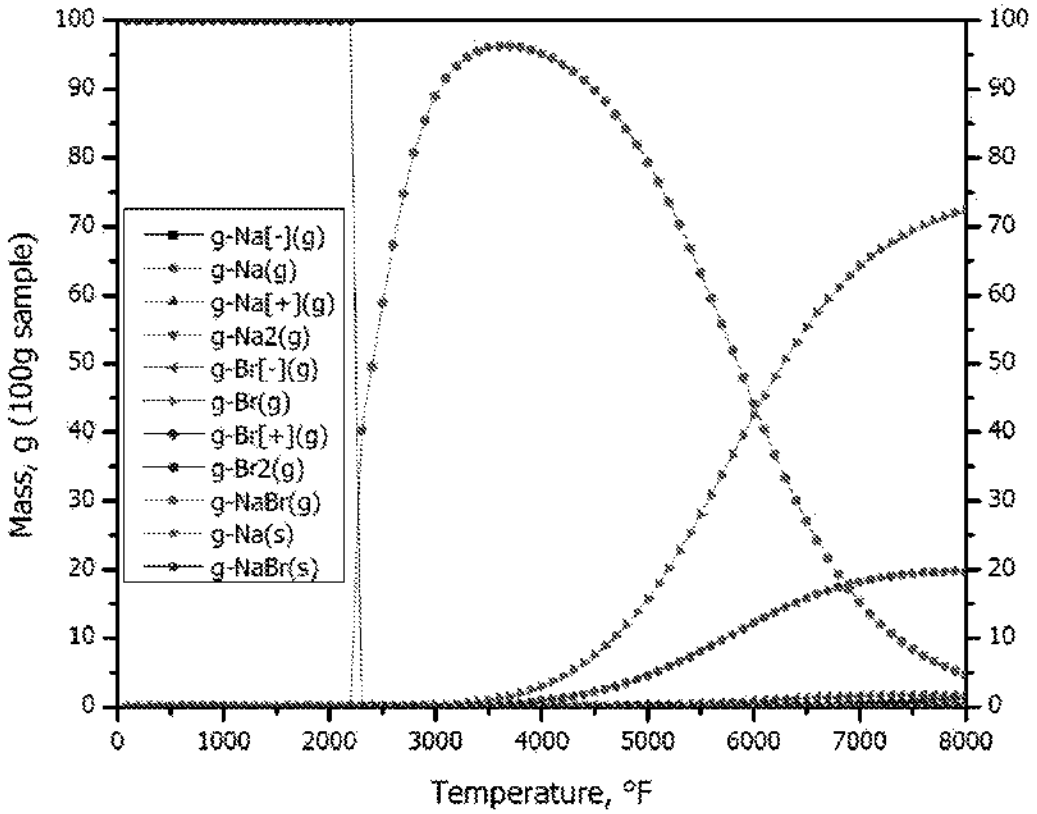


Figure 1. NaBr FactSage equilibrium calculation.

24. Not shown in Figure 1, the gaseous NaBr reacts with water molecules in the flue gas to form HBr, via $NaBr + H_2O \rightarrow NaOH + HBr$, see, Yang and discussion thereof at item 19 herein. The HBr is then available to react with Hg^0 released by the coal and with activated carbon sorbent that has been introduced further downstream into the flue gas.

25. The effect of chlorides in coal on flue gas HCl content has been studied much more than the effect of bromides on coal on flue gas HBr content, due in part to federal HCl emission regulations. Chlorides, like bromides, also exhibit a similar transformation to hydrogen chloride in coal combustion flue gas, see, Robl and discussion thereof at item 21 herein. Hydrogen chloride, as an acid gas, is one of the emission categories that the EPA regulates through the Mercury Air Toxics Standards (MATS)[2]. The MATS includes specific HCl limits that power plants must comply with by performing quarterly EPA

[2] https://www.epa.gov/mats

Method 26(A)[3] stack sampling to verify compliance. Inorganic and organically bound chlorides in the coal are volatilized and decomposed in the furnace and form HCl in the flue gas.

26. As shown in the report "Pilot- and full-scale demonstration of advanced mercury control technologies for lignite-fired power plants", S. Benson et al., Energy & Environmental Research Center, Final report, U.S. Department of Energy, National Energy Technology Laboratory, February 2005 ("Benson 1"), at figure 31 on page 37, addition of NaCl to lignite coal in a pilot-scale coal combustion system caused an increased HCl concentration in the flue gas. The HCl concentration in the flue gas increased with increased amounts of NaCl on the coal. Benson 1 shows at figure 36 on page 41 that addition of $CaCl_2$ to the coal caused increased HCl concentration in the flue gas. The HCl concentration in the flue gas increased with increasing amounts of $CaCl_2$ on the coal. Figures 31 and 36 of Benson 1 are reproduced below.

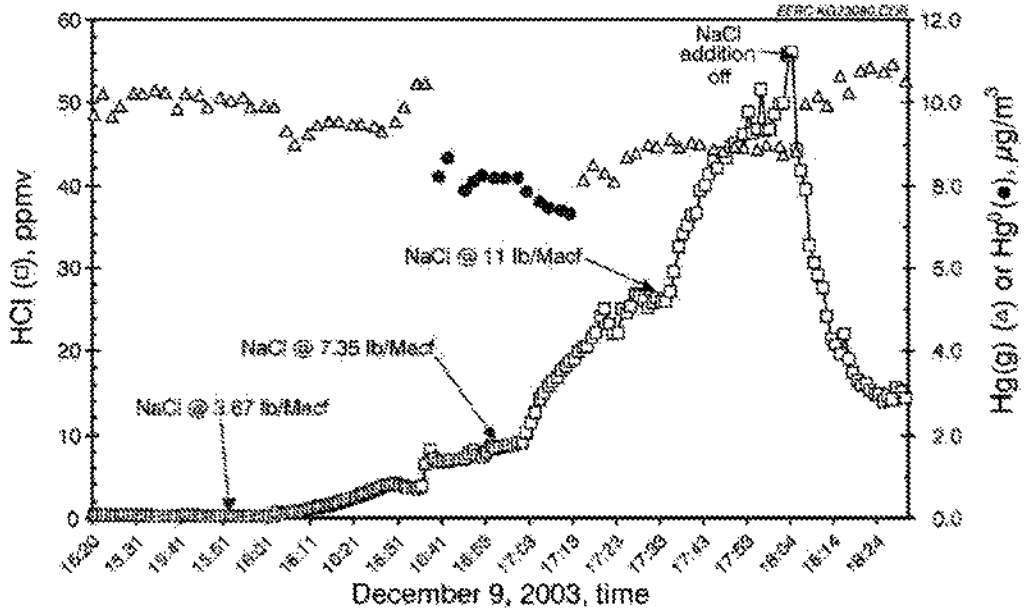


Figure 31. Temporal variations in SDA inlet HCl and FF outlet Hg(g) and Hg^0 concentrations as NaCl was added to the Center lignite coal.

[3] https://www.epa.gov/emc/method-26a-hydrogen-halide-and-halogen-isokinetic-method

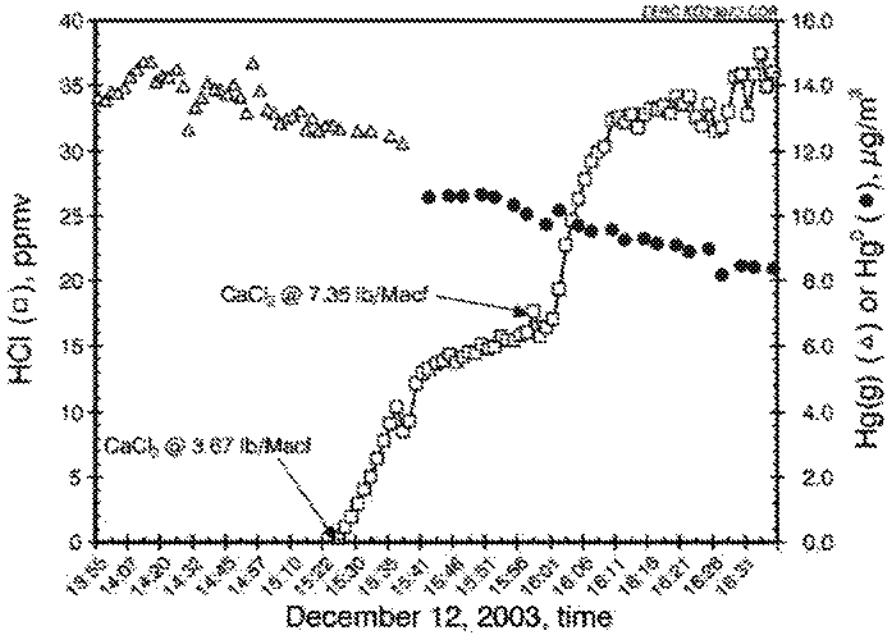


Figure 36. Temporal variations in SDA inlet HCl and FF outlet Hg(g) and Hg^0 concentrations during $CaCl_2$ additions to the Center lignite coal.

27. As shown in the report "JV Task 73—Mercury control technologies for electric utilities burning subbituminous coals", S. Benson et al., Energy and Environmental Research Center, Draft final report, June 2005 ("Benson 2"), at figure 11-11 at page 48, addition of $CaCl_2$ to subbituminous coal in a pilot-scale coal combustion system caused an increased HCl concentration in the flue gas. The HCl concentration in the flue gas increased with increased amounts of $CaCl_2$ on the coal. Figure 11-11 of Benson 2 is reproduced below.

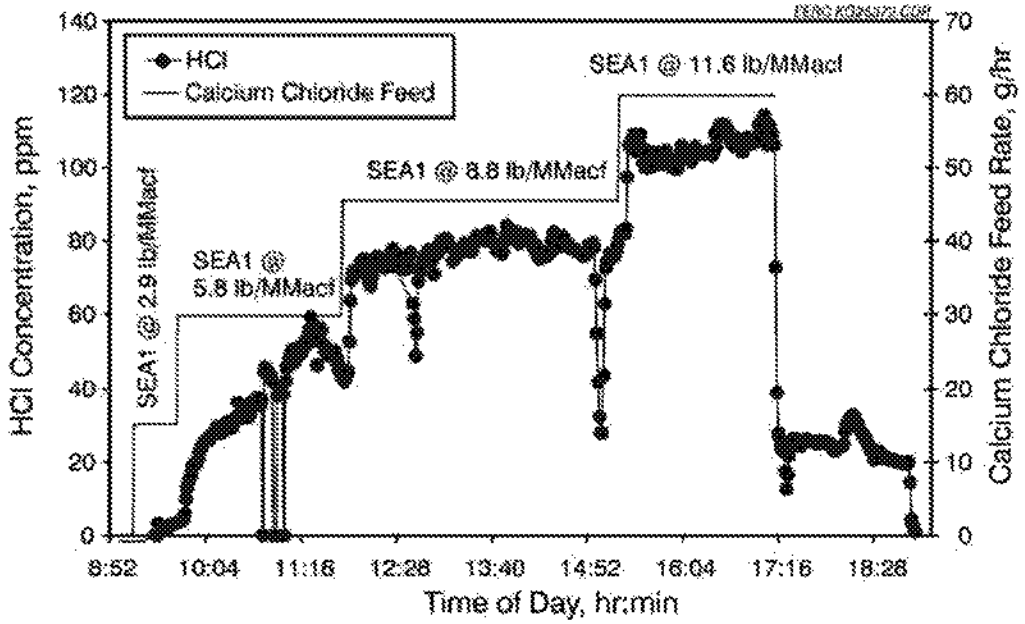


Figure 11-11. Temporal variations in ESP outlet HCl concentrations and SEA1 ($CaCl_2$) addition rates.

28. As shown by items 19-27 herein, in a coal-fired power plant, placing halide salts on the coal or in the combustion chamber results in formation of gaseous halide salt in the flue gas and formation of the respective hydrogen halide in the flue gas. Placing bromide salts such as NaBr or $CaBr_2$ on the coal or in the combustion chamber results in formation of gaseous NaBr or $CaBr_2$ in the flue gas, as well as formation of HBr in the flue gas. Likewise, placing chloride salts such as NaCl or $CaCl_2$ on coal or in the combustion chamber results in formation gasoues NaCl or $CaCl_2$ in the flue gas, as well as the formation of HCl in the flue gas.

29. Wikipedia defines "salt" as "...an ionic compound that can be formed by the neutralization reaction of an acid and a base. Salts are composed of related numbers of cations (positively charged ions) and anions (negative ions) so that the product is electrically neutral (without a net charge). These component ions can be inorganic, such as chloride (Cl^-), or organic, such as acetate ($CH_3CO_2^{-1}$); and can be monatomic, such as

fluoride (F^-), or polyatomic, such as sulfate (SO_4^{-2})." See, https://en.wikipedia.org/wiki/Salt_(chemistry).

30. Dictionary.com defines "bromide" as "Wikipedia defines "NaBr" as "a salt of hydrobromic acid consisting of two elements, one of which is bromine, as sodium bromide, NaBr." See, https://www.dictionary.com/browse/bromide.

31. Dictionary.com defines "salt" as "a Wikipedia defines "NaCl" as "a crystalline compound, sodium chloride, NaCl, occurring as a mineral, a constituent of seawater, etc., and used for seasoning food, as a preservative, etc." See, https://www.dictionary.com/browse/salt?s=t.

32. Sigma-Aldrich has an online products page entitled "Sodium Salts" that includes sodium bromide and sodium chloride. See, https://www.sigmaaldrich.com/materials-science/material-science-products.html?TablePage=19295381.

33. As shown by items 29-32 herein, NaBr is a salt that includes Na^+ ions and Br^- ions. NaCl is a salt that includes Na^+ ions and Cl^- ions. $CaBr_2$ is a salt that includes Ca^+ ions and Br^- ions. $CaCl_2$ is a salt that includes Ca^+ ions and Cl^- ions.

34. We further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and/or any patent issued thereon.

Dated: March 20, 2019 By: / John Pavlish /

John Pavlish

Dated: March 15, 2019 By: / Nicholas Lentz /

Nicholas Lentz

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/978,760 Group Art Unit: 1776
Filed: May 14, 2018 Docket No.: 4820.007US4
Confirmation No.: 6432
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

DECLARATION B

I, John Pavlish, declare and say as follows:

1. I have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competitiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and

technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

2. U.S. patent publication no. 2004/0003716 ("Nelson") describes treatment of activated carbon outside the flue gas with hydrogen bromide (HBr), and describes testing to measure the percent mercury removal when the treated activated carbon was injected into either simulated or actual flue gas at various injection rates. Specifically, Nelson performed experiments in Example 5 (paragraphs [0082]-[0085]) and 7 (paragraphs [0089]-[0092]), and provides the data in FIG. 14 and FIG. 15.

3. In Example 5, Nelson treated Norit DARCO® FGD with gaseous HBr, and tested its use by injecting the HBr-treated sorbent into a simulated coal-fired flue-gas stream in a pilot-scale test system. Nelson's FIG. 14 shows data for one activated carbon sample treated with HBr. The activated carbon had 10 wt% HBr, and at a sorbent injection rate of about 3.7 lb/MMacf gave a mercury removal of about 82%.

4. In Example 7, Nelson treated Norit DARCO® FGD with gaseous HBr, and tested its use in a coal-fired power plant by injecting the treated sorbent into the flue gas prior to the electrostatic precipitator (ESP). Nelson's FIG. 15 shows data for two activated carbon samples treated with HBr. The two activated carbon samples contained 9 wt% HBr. The data in FIG. 15 for the two HBr-treated sorbents show that at a sorbent injection rate of about 2.2 lb/MMacf, 45% of the mercury was removed, and at a sobent injection rate of about 4.2 lb/MMacf, 62% of the mercury was removed.

5. The percent mercury removal, and the percent mercury removal per 1 wt% HBr additive on the sorbent, versus the sorbent injection rate for Nelson's HBr-treated activated carbon formed in Nelson's Examples 5 and 7 is given in the table below. The

percent mercury removal per 1 wt% HBr was calculated as the percent mercury removal divided by the HBr wt% on the sorbent. The units "lb/MMacf" are pounds of sorbent per 1 million actual cubic feet of flue gas.

Sample	Additive	Sorbent Description	Sorbent Injection Rate (lb/MMacf)	HBr wt% on Sorbent	%Hg Removal	%Hg Removal per 1 wt% HBr on Sorbent
N1	HBr outside flue gas	Norit DARCO® FGD	3.7	10	82	8.2
N2	HBr outside flue gas	Norit DARCO® FGD	2.2	9	45	5.0
N3	HBr outside flue gas	Norit DARCO® FGD	4.2	9	62	6.8

6. A bromine-treated activated carbon was prepared by exposing activated carbon (Norit DARCO® Hg, an activated carbon that a Norit Americas technical representative told me was rebranded for mercury control applications and was previously referred to as Norit DARCO® FGD) to gaseous bromine. A cement mixer was used to expose the activated carbon to the bromine gas. Tumbling vanes produced a dispersion of the activated carbon within the barrel. A cover was fit over the opening to keep the activated carbon dispersion inside the barrel. In the center of the lid, a small hole was drilled, and a tube extended to the center of the barrel. The tube was attached to a source of bromine vapor (Br_2) in dry nitrogen via a swivel so that the tube in the barrel would rotate and the tube to the source would be stationary. A charge of 1 to 5 kg of the activated carbon was weighed and transferred to the barrel. The weight of bromine transferred to the barrel was equal to 5 weight % of the amount of activated carbon.

7. An HCl-treated activated carbon was prepared by exposing activated carbon (Norit DARCO® Hg) to gaseous HCl. The carbon was weighed and added to a flask which was attached to a rotary apparatus. A hard-plastic tube was inserted into the

condenser end of the apparatus for introduction of the HCl/nitrogen gas mix. This extended to the center of the flask. HCl from a cylinder was run through a flow meter and mixed with a low flow of nitrogen in a T-tube attached to the inlet tube. The flow rate was set to provide 5 wt % HCl over 15 minutes exposure. The flask was slowly rotated in the apparatus at room temperature so that the carbon turned over but did not exit the flask. After the exposure period, the HCl flow was stopped and the HCl-treated activated carbon was removed.

8. A pilot-scale 550,000-Btu/hr pulverized coal (pc)-fired test unit was used to combust subbituminous coal and test mercury control using various sorbents. The coal combustion flue gas exiting the pilot unit was cooled down to a nominal temperature of 149°C (300°F) and then was introduced into a single wire tubular ESP unit. Activated carbon sorbents were fed with a K-Tron dual-screw feeder upstream of the ESP. The feeder was calibrated prior to the start of each carbon injection test. No scrubber was used. Before Hg control testing began, a baseline condition was established with the pilot-scale unit, and flue gas mercury content was measured before each test as about 6-10 $\mu g/m^3$. The flue gas HCl concentration, with no additives on the coal, as calculated by the chlorine measured in the coal, was 2-5 ppm. Percent mercury removal was then measured for the activated carbon alone (untreated), the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure, and with sodium bromide (NaBr) or sodium chloride (NaCl) added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas.

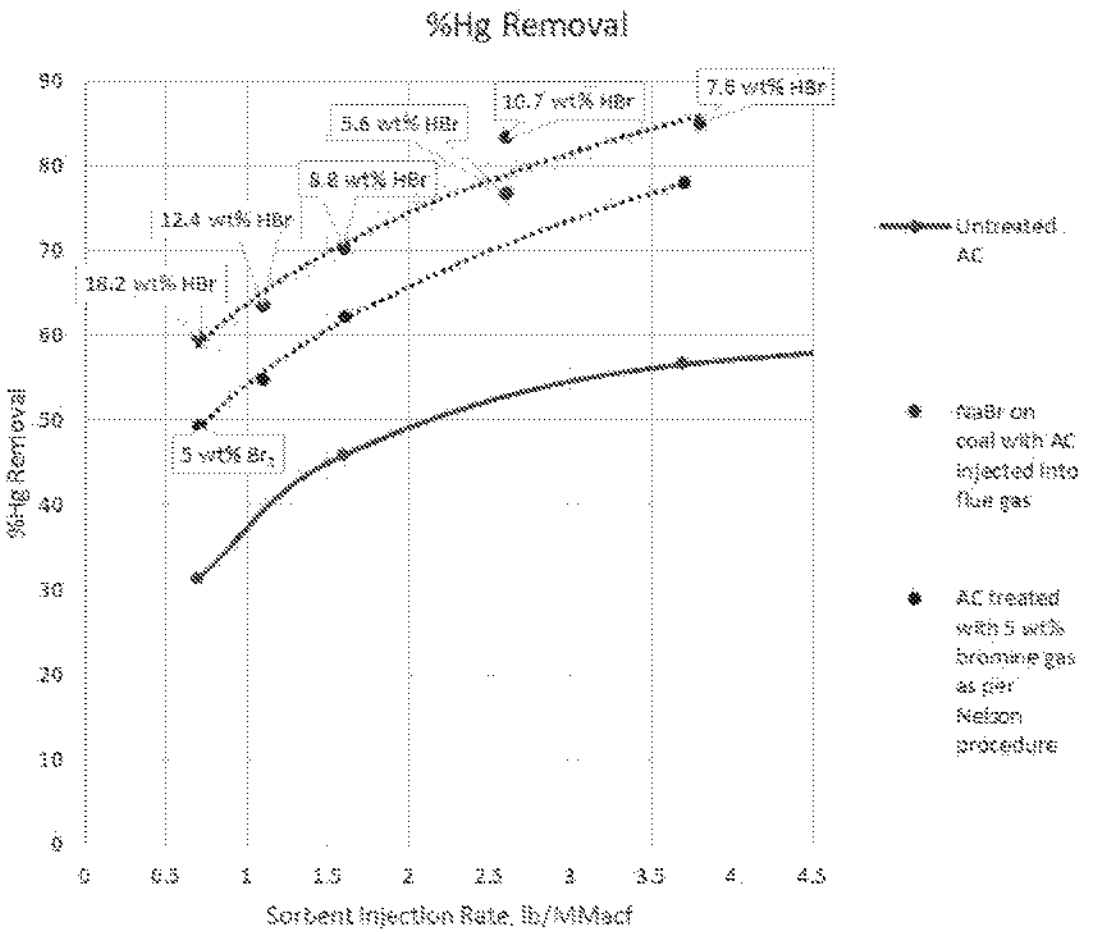
9. The results of the pilot-scale test with untreated activated carbon and with the activated carbon treated with Br_2 outside the flue gas described herein at item 6 are given in the table below.

Sample	Additive	Sorbent Description	Sorbent Injection Rate (lb/MMacf)	Br_2 wt% on Sorbent	%Hg Removal
1	None	Norit DARCO® Hg	0.7	0	31.4
2	None	Norit DARCO® Hg	1.6	0	45.9
3	None	Norit DARCO® Hg	3.7	0	56.6
4	None	Norit DARCO® Hg	9.2	0	61.2
5	None	Norit DARCO® Hg	25.7	0	62.5
6	Br_2 outside flue gas	Norit DARCO® Hg	0.7	5	49.5
7	Br_2 outside flue gas	Norit DARCO® Hg	1.1	5	54.9
8	Br_2 outside flue gas	Norit DARCO® Hg	1.6	5	62.2
9	Br_2 outside flue gas	Norit DARCO® Hg	3.7	5	78.1

10. The results from the pilot-scale test with sorbent enhancement additives (SEAs) NaBr or NaCl added to coal along with injection of untreated activated carbon into the flue gas, and with the activated carbon treated with HCl outside the flue gas described at item 7, are given in the table below. The bromide (Br^-) or chloride (Cl^-) injection rate was calculated as the SEA injection rate times the fraction of the additive (based on molecular weight) that is Br^- or Cl^-, for Br^-, Br^-/NaBr = 79.904/(79.904+22.9898) = 0.7766; for Cl^-, Cl^-/NaCl = 35.453/(35.453+22.9898) = 0.6066. The HBr or hydrogen chloride (HCl) equivalent injection rate was calculated as the Br^- or Cl^- injection rate times the molecular weight ratio of HBr/Br^- or of HCl/Cl^-; for HBr/Br^-, this is (1.00794+79.904)/79.904 = 1.013; for HCl/Cl^-, this is (1.00794+35.453)/35.453 = 1.028. The equivalent HBr or HCl wt% on sorbent was calculated as the HBr or HCl injection rate divided by the sum of the sorbent injection rate and the HBr or HCl injection rate (e.g., 100% of the HBr or HCl was assumed to react with the sorbent). The percent mercury removal per 1 wt% HBr or HCl was calculated as the percent mercury removal divided by the HBr wt% or HCl wt% on sorbent.

Sample	Additive	Additive injection rate (lb/MMacf)	Sorbent description	Sorbent injection rate (lb/MMacf)	Br or Cl injection rate (lb/MMacf)	HBr or HCl equivalent injection rate (lb/MMacf)	Equivalent HBr or HCl wt% on sorbent	%Hg removal	%Hg removal per 1 wt% HCl or HBr on sorbent	Milligrams HBr or HCl/MMacf per 1% Hg Removal
13	NaBr on coal	0.2	Norit DARCO® Hg	0.7	0.16	0.16	18.2	59.8	3.3	1211
14	NaBr on coal	0.2	Norit DARCO® Hg	1.1	0.16	0.16	12.4	63.6	5.1	1139
15	NaBr on coal	0.2	Norit DARCO® Hg	1.6	0.16	0.16	8.8	70.4	18.0	1029
16	NaBr on coal	0.2	Norit DARCO® Hg	2.6	0.16	0.16	5.6	76.7	13.6	944
17	NaBr on coal	0.4	Norit DARCO® Hg	2.6	0.31	0.31	10.7	83.3	7.8	1739
18	NaBr on coal	0.4	Norit DARCO® Hg	3.8	0.31	0.31	7.6	85.1	11.3	1702
19	NaCl on coal	2.4	Norit DARCO® Hg	0.7	1.46	1.50	67.5	60.6	0.9	11202
20	NaCl on coal	3.4	Norit DARCO® Hg	0.7	2.06	2.12	74.7	61.2	0.8	15714
21	NaCl on coal	4.9	Norit DARCO® Hg	0.7	2.97	3.06	80.9	57.8	0.7	23979
22	NaCl on coal	4.9	Norit DARCO® Hg	1.1	2.97	3.06	73.0	67.4	0.9	20564
23	NaCl on coal	4.9	Norit DARCO® Hg	1.6	2.97	3.06	65.0	69.6	1.1	19914
24	NaCl on coal	6.9	Norit DARCO® Hg	1.6	4.19	4.30	72.3	71.2	1.0	27412
25	HCl outside flue gas	0	Norit DARCO® Hg	0.7	0.04	0.04	5.0	27.9	5.6	569
26	HCl outside flue gas	0	Norit DARCO® Hg	1.6	0.08	0.08	5.0	34.2	6.8	1061
27	HCl outside flue gas	0	Norit DARCO® Hg	2.6	0.13	0.13	5.0	35.1	7.0	1680
28	HCl outside flue gas	0	Norit DARCO® Hg	4.9	0.24	0.25	5.0	40.3	8.1	2757
29	HCl outside flue gas	0	Norit DARCO® Hg	7.7	0.37	0.39	5.0	43.9	8.8	3978
30	HCl outside flue gas	0	Norit DARCO® Hg	15.5	0.75	0.78	5.0	52.9	10.6	6645

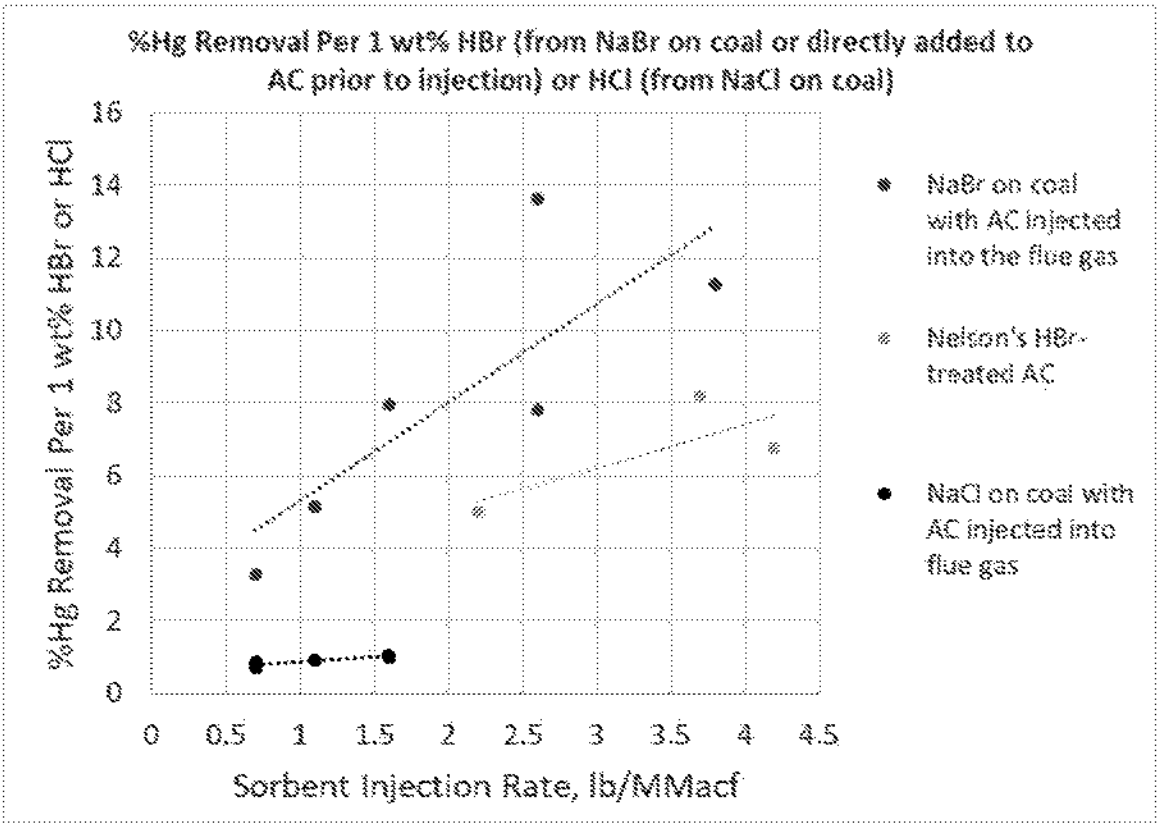
11. The following plot shows the percent mercury removal versus the sorbent injection rate for the activated carbon alone (untreated), the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure, and for NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. All of the data in the following plot is taken from the data in the tables at item 9 and 10, which was produced using the same pilot-scale setup described at item 8.

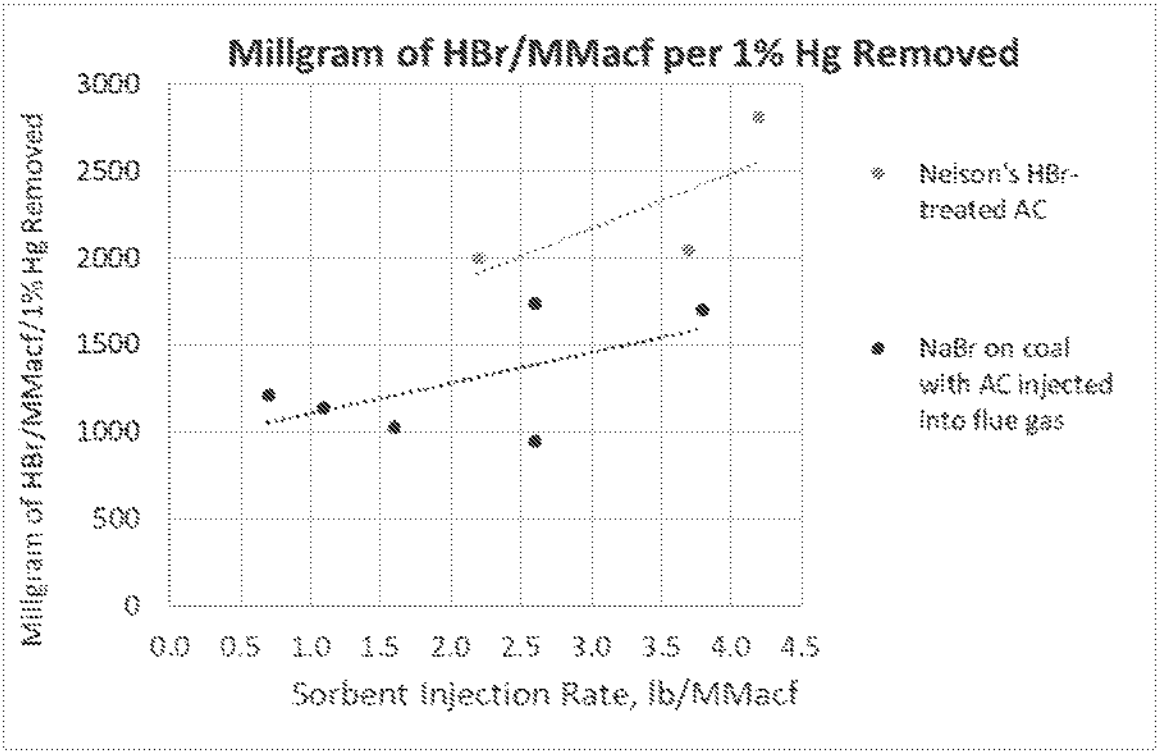


12. The data in the plot above show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas (in-flight promotion with Br^-) provided a higher percent of mercury removal at all tested sorbent

injection rates as compared to the activated carbon alone (untreated) and compared to the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure. With NaBr added to the coal and activated carbon injected into the flue gas, there was a significant reduction in the amount of sorbent required to acheive similar mercury removal compared to the activated carbon treated with Br_2 outside the flue gas. For example, to acheive 70% mercury removal, 2.5 lb/MMacf of Br_2-treated carbon was required, as compared to 1.6 lb/MMacf with NaBr added to the coal and activated carbon injected into the flue gas; an additional (2.5-1.6/1.6)*100% or 56% treated sorbent was required to achieve the same leval of mercury removal.

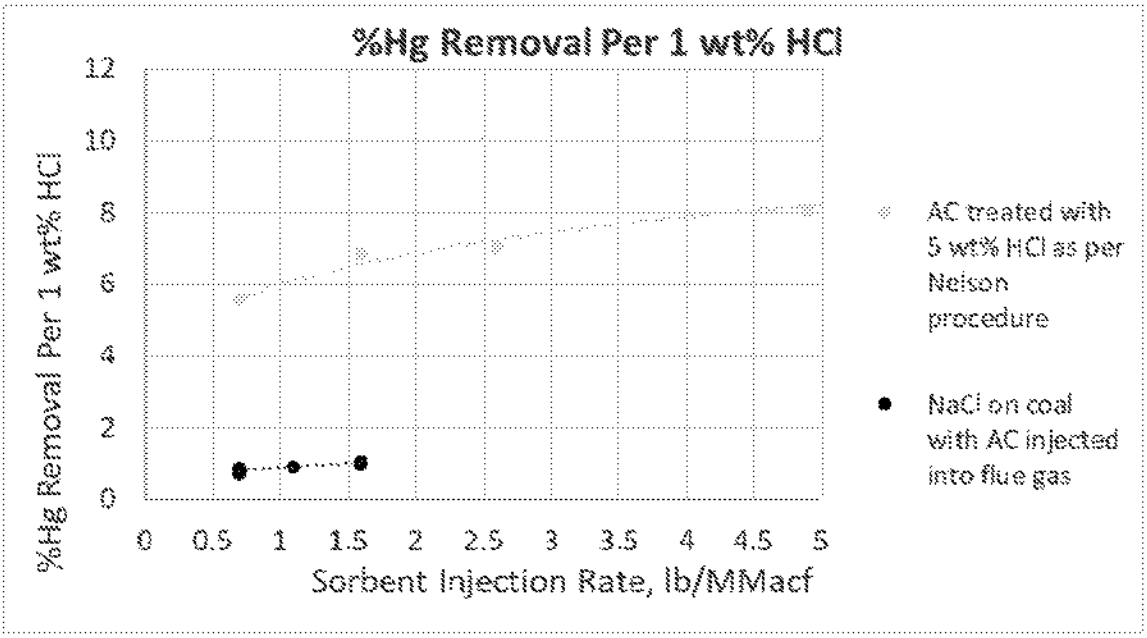
13. The following first plot shows the percent mercury removal per 1 wt% HBr or HCl versus the sorbent injection rate with NaBr or NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for Nelson's activated carbon treated with HBr outside the flue gas. The following second plot shows the milligrams of HBr/MMacf per 1% mercury removal versus the sorbent injection rate with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for Nelson's activated carbon treated with HBr outside the flue gas; NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas was omitted from this plot because the values for the milligrams of HCl/MMacf per 1% mercury removal were so high (about 10,000 to 30,000). The data sets in the following first and second plots "NaBr on coal with AC injected into the flue gas" and "NaCl on coal with AC injected into flue gas" are taken from the data in table at item 10, which was produced using the same pilot-scale setup described at item 8. The data set in the following first and second plots "Nelson's HBr-treated AC" is taken from the table at item 5, which is from Nelson's experimental setup.

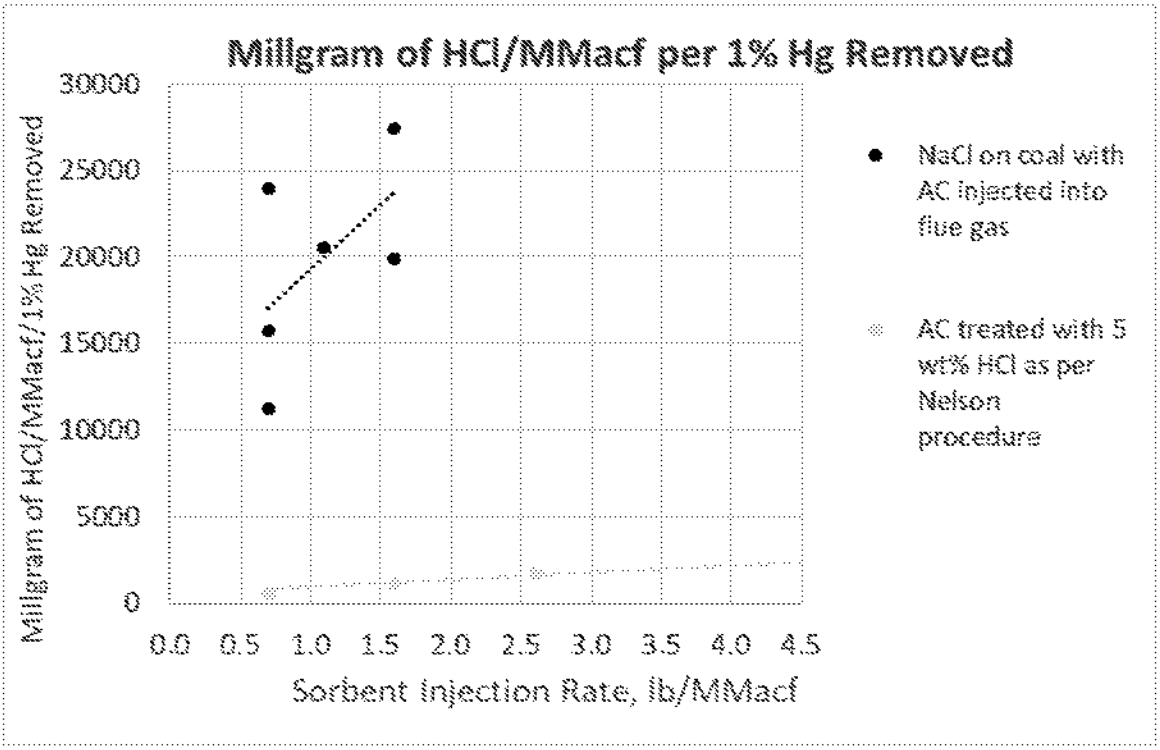

%Hg Removal Per 1 wt% HBr (from NaBr on coal or directly added to AC prior to injection) or HCl (from NaCl on coal)
%Hg Removal Per 1 wt% HBr or HCl
0
2
4
6
8
10
12
14
16
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Sorbent Injection Rate, lb/MMacf
NaBr on coal with AC injected into the flue gas
Nelson's HBr-treated AC
NaCl on coal with AC injected into flue gas


Millgram of HBr/MMacf per 1% Hg Removed
Millgram of HBr/MMacf/1% Hg Removed
0
500
1000
1500
2000
2500
3000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Sorbent Injection Rate, lb/MMacf
Nelson's HBr-treated AC
NaBr on coal with AC injected into flue gas

14. The data in the first plot above show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 2x) percent mercury removal per 1 wt% HBr at all tested sorbent injection rates as compared to Nelson's activated carbon treated with HBr outside the flue gas. Further, the data show that NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 6-8x) percent mercruy removal per 1 wt% HBr or HCl at all tested sorbent injection rates compared to the NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The data in the second plot above shows that NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly lower milligrams of HBr/MMacf per 1% mercury removal at all tested sorbent injection rates as compared to Nelson's activated carbon treated with HBr outside the flue gas, indicating more efficient (approximately 2x) use of HBr for mercury removal during in-flight promotion of activated carbon than treatment of activated carbon outside the flue gas.

15. The following first plot shows the percent mercury removal per 1 wt% HCl versus the sorbent injection rate for NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure. The following second plot shows the milligrams of HCl/MMacf per 1% mercury removal versus the sorbent injection rate with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure. The data sets in the following first and second plots are taken from the data in table at item 10, which was produced using the same pilot-scale setup described at item 8.





16. The data in the first plot above show that activated carbon treated with HCl outside the flue gas as per the Nelson procedure provided a much higher percent of mercury removal per 1 wt% HCl at all tested sorbent injection rates as compared to NaCl

added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The data in the second plot above show that the milligrams of HCl/MMacf per 1% mercury removal versus the sorbent injection rate with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas was significantly higher as compared to the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure, indicating more efficient use of HCl for mercury removal by treatment of activated carbon outside the flue gas than by promotion in-flight.

17. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and/or any patent issued thereon.

Dated: March 20, 2019

By: / John Pavlish /

John Pavlish

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/978,760 Group Art Unit: 1776
Filed: May 14, 2018 Docket No.: 4820.007US4
Confirmation No.: 6432
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

DECLARATION A

I, John Pavlish, declare and say as follows:

1. I have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competitiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and

technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

2. Herein, when I refer to the invention I am referring to a method of separating mercury from a mercury-containing gas as described in independent claim 2 of U.S. patent application serial no. 15/978,760. All websites referenced in this document were accessed March 20, 2019.

The EPA Calls For New Mercury Removal Technology in the 1990s

3. The background story for this technology begins with the Clean Air Act Amendments of 1990. That law required the U.S. Environmental Protection Agency (EPA) to study the impact of various air pollutants, including mercury.[1] To assist in the research, in 1992, the EPA established a National Center for Excellence at the Energy & Environmental Research Center (EERC) referred to as the Center for Air Toxic Metals (CATM). It is through the EERC that my fellow co-inventors and I would eventually discover the invention claimed in U.S. patent application serial no. 15/978,760. Our research focused heavily on developing new methods for detecting, measuring, and ultimately, removing mercury from coal-fired power plant exhaust gas.

4. In 1997 and 1998, the EPA issued two reports to Congress: *Mercury Study Report to Congress* (issued December 1997)[2] and *Study of Hazardous Air Pollutant Emissions*

[1] Website: https://www.epa.gov/clean-air-act-overview/1990-clean-air-act-amendment-summary-title-iii

[2] United States Environmental Protection Agency, "Mercury Study Report to Congress, Volume I: Executive Summary", EPA-452/R-97-003, December 1997, https://www.epa.gov/mercury/mercury-study-report-congress

from Electric Utility Steam (issued February 1998)[3]. As an outcome of these studies, the EPA found a pressing need for regulation of mercury pollution from power plants.[4] Unfortunately, it also found that no existing technologies were up to the task of significantly reducing the mercury pollution from those plants.[5]

5. With that said, the EPA did provide some indications as to promising areas for future research. For example, similar to cited reference U.S. patent no. 5,435,980 ("Felsvang"), the EPA noted a connection between the chlorine content in coal and potential ways to remove mercury.[6] It also identified activated carbon injection as a potential control technology for mercury removal.[7] Nonetheless, it acknowledged that much more research was needed:

> Research continues on the chemistry and interactions of flue gas, fly ash, and mercury species. This fundamental research is needed at various flue gas conditions encountered across the utility industry in order to develop low cost mercury strategies for full-scale utility operation. Thus, while AC injection shows promise as a mercury control technology, more data and research are needed to understand the factors that affect mercury removal.[8]

6. In the wake of these reports, various governmental and industry organizations injected millions of dollars into basic scientific research and experimental studies in the

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[3] United States Environmental Protection Agency, "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units -- Final Report to Congress", United States Office of Air Quality EPA-453/R-98-004a, Environmental Protection Planning and Standards, February 1998, https://www.epa.gov/mats/study-hazardous-air-pollutant-emissions-electric-utility-steam-generating-units-final-report

[4] On March 15, 2005, the EPA issued the Clean Air Mercury Rule to significantly reduce mercury emissions from coal-fired power plants, with a goal of reducing utility emissions of mercury from 48 tons/year to 15 tons/year, a reduction of nearly 70 percent. See, https://en.wikipedia.org/wiki/Mercury_regulation_in_the_United_States.

[5] Footnote 3 reference at ES-19, "Regarding potential methods for reducing mercury emissions, the EPA has not identified any demonstrated add-on control technologies currently in use in the U.S. that effectively remove mercury from utility emissions."

[6] Footnote 3 reference at section 13, pages 37-38.

[7] Footnote 3 reference at section 13, pages 40-41.

[8] Footnote 3 reference at section 13, page 43, second full paragraph.

search for new mercury removal technologies.[9] Because increased regulation of mercury emissions was expected to require significant upgrades to the country's fleet of coal-fired plants, much of the research focused on retrofit technologies that could be adopted at relatively low cost, including sorbent injection systems[10].

The EPA Espouses the Conventional Wisdom in Favor of Pre-Treated Sorbents, Not In-Flight Sorbent Enhancement in the Flue Gas

7. In 2002, the EPA surveyed the state of research in this field and produced a follow-up report.[11] It noted that the complex chemistry of the coal combustion process was still not fully understood, but that progress had been made. It described how coals with higher halogen content (specifically, chlorine) were better able to oxidize mercury and promote its capture.[12] However, it also noted that this oxidation reaction could be inhibited by other chemicals present during combustion in the boiler.[13] The EPA also described promising experiments being performed with halogen-treated sorbents.[14]

8. Notably, the EPA did not recommend in-flight sorbent enhancement in the flue gas by spraying additives on coal or injecting halogens into the boiler. Rather, it described research into methods for *pre-treating* sorbents with various additives, including chlorine, and then injecting those pre-treated sorbents downstream from the

[9] T. D. Brown, D. N. Smith, R. A. Hargis Jr., W. J. O'Dowd, 1999, Mercury Measurement and Its Control: What We Know, Have Learned, and Need to Further Investigate, Journal of the Air & Waste Management Association, 49:6, 1-97, DOI: 10.1080/10473289.1999.10463841
[10] Footnote 9 reference at page 80, first column.
[11] J. D. Kilgroe, C. B. Sedman, R. K. Srivastava, J. V. Ryan, C. W. Lee, S. A. Thorneloe, Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report, U.S. Environmental Protection Agency, Office of Research and Development, EPA-600/R-01-109, December 2001
[12] Footnote 11 reference at section 6, page 7, first full paragraph.
[13] Footnote 11 reference at section 5, page 7, second full paragraph "It is speculated that SO_2 and water vapor may inhibit gas-phase oxidation of Hg^0 by scavenging the chlorinating agent."
[14] Footnote 11 reference at ES-8, second-to-last full paragraph, "Impregnation of carbons with sulfur, iodine, or chlorine can increase the reactivity and capacity of sorbents."

boiler.[15] This approach ensured that, e.g., chlorinating agents could react with the sorbent material without being "scavenged" by other chemicals present in the boiler. This approach also ensured that the sorbent additive would have plenty of time to react with the sorbent—the EPA explained that, for many plants, injected sorbents would have only a few seconds to find and react with mercury present in the flue gas, with high and costly carbon-to-Hg ratios needed to achieve adequate mercury removal.[16] This is consistent with the general understanding in the industry that sorbent additives such as halogens or halides should be mixed with sorbents *before* coming in contact with mercury-containing flue gas.

Sidney Nelson Touts Brominated Sorbent, Not In-Flight Sorbent Enhancement in the Flue Gas

9. The same year the EPA published its follow-up report,[17] on April 24, 2002, Sidney Nelson filed the provisional application for the cited reference U.S. patent publication no. 2004/0003716 ("Nelson"), U.S. provisional application no. 60/377,790 ("Nelson provisional"). His application reported experiments that he had conducted using sorbents pre-treated with Br_2 and HBr. His application demonstrated that those pre-treated sorbents could outperform some commercially available sorbents, explaining exposing the activated carbon to concentrated forms of Br_2 or HBr outside the flue gas allows a relatively large quantity of the concentrated Br_2 or HBr to react with the activated carbon.[18]

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[15] Footnote 11 reference at section 5, paragraph bridging pages 33-34.
[16] Footnote 11 reference at 5-33, "Activated carbon duct injection seems to be the most promising Hg control technology for coal-fired electric utility boilers equipped with ESPs. In this technology, the injected activated carbon removes Hg only while contacting the flue gas during very limited sorbent/gas contact time (<3 seconds)." Note that this section of the report refers to the reaction between pre-treated chlorinated sorbent and mercury as occurring "in-flight." To be clear, this portion of the report describes only the use of a pre-treated sorbent, not the claimed invention.
[17] Footnote 11 reference.
[18] Nelson at paragraph [0043], "…it appears that in exposing PAC to concentrated bromine gas, a relatively large quantity of the bromine reacts with the carbon, forming surface compounds on the large surface-area of the carbon."

10. Consistent with EPA teachings, Nelson did not recommend or teach adding chemicals to the flue gas or in-flight mixing of Br_2 and HBr with sorbents. Quite the contrary, he recommended that the bromine be contacted with the sorbent outside the presence of boiler gases "…for a sufficient time…" to ensure that enough bromine reacted with the sorbent.[19] Treatment times for HBr- and Br_2-treatment of activated carbon described by Nelson were on the order of several minutes (1.5-100 minutes)[20]; in contrast, only a few seconds are available for in-flight sorbent enhancement in the flue gas (e.g., generally less than 10 seconds)[16]. He also identified an even further reason to avoid in-flight sorbent enhancement in the flue gas: he noted that bromine compounds are "…quite corrosive."[21] As a result, he recommended mixing bromine and sorbent in equipment "…preferably lined with corrosion-resistant material…"[21] such as Teflon[22]—— an approach that is not possible when bromine is added to coal or injected upstream from or into the boiler.

11. Despite the development of brominated sorbents and other advancements in the field, by 2003, the EPA recognized that there was still no "single best technology that can be broadly applied" for mercury capture.[23]

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[19] Nelson at paragraphs [0023], [0028], and claim 1.
[20] Nelson at page 8, paragraph [0087] and the table at the top of the second column. For HBr-treated activated carbon, the adsorption rate was 1 gram of HBr absorbed per 1 kg of activated carbon per minute, or 0.1 wt% HBr absorbed per minute, meaning that to reach the 9 wt% HBr reported in the table required about 90 minutes. Note that Figure 14 reports results for 10 wt% HBr, and Figure 15 reports results for 9 wt% HBr. For Br_2-treated activated carbon, the adsorption rate was 10 grams of Br_2 absorbed per 1 kg of activated carbon per minute, or 1 wt% Br_2 absorbed per minute, meaning that to reach the 15 wt% Br_2 reported in the table required about 15 minutes. Note that Figures 14 and 15 report results for 1.5 wt%, 5 wt%, and 15 wt% Br_2, according to the table requiring about 1.5 to 15 minutes to form.
[21] Nelson at paragraph [0044].
[22] Nelson provisional at page 4, last paragraph.
[23] J. H. Pavlish, E. A. Sondreal, M. D. Mann, E. S. Olson, K. C. Galbreath, D. L. Laudal, S. A. Benson, "Status Review of Mercury Control Options for Coal-Fired Power Plants", Fuel Processing Technology 82 (2003) 89–165, at page 89, first paragraph.

The EPA Continues to Teach Away from In-Flight Sorbent Enhancement in the Flue Gas

12. In 2005, the EPA issued another follow-on report.[24] In this report, the EPA again noted the connection between chlorine content in coal and mercury capture.[25] It also recognized the advantages of brominated carbon sorbents.[26] The report also notes that halogen-containing sorbent enhancement additives have been added to coal along with injection of activated carbon sorbents into the flue gas to remove mercury.[27] However, despite being aware of these facts—facts that the examiner has relied on to demonstrate obviousness of the claims at issue—in the final summary the EPA does not recommend, or even mention, in-flight sorbent enhancement in the flue gas.[28] Although the EPA's "key observations" for retrofitting the country's coal plant fleet mention the use of fuel additives and the injection of activated carbon into the flue gas, the use of these technologies together is not mentioned, and in-flight enhancement of the sorbent in the flue gas is not mentioned; rather, injection of pre-treated halogenated activated carbon is emphasized.[29]

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[24] U.S. Environmental Protection Agency, "Control of Mercury Emissions from Coal Fired Electric Utility Boilers: An Update", Air Pollution Prevention and Control Division, National Risk Management Research Laboratory, Office of Research and Development, February 18, 2005

[25] Footnote 24 reference at page 25, third-to-last bullet point. See also, page 10, second paragraph, with regard to chloride salts on coal, noting that "Long term effects, such as corrosion, plugging, impacts on combustion equipment could not be assessed during the short-term parametric tests. Therefore, the use of coal additives offer some promise at improving mercury capture; however, they may have other impacts that need to be evaluated."

[26] Footnote 24 reference at pages 18-21.

[27] Footnote 24 reference at page 22, second paragraph. See also, page 24, second-to-last full paragraph, "Additives used to enhance PAC performance or other sorbents that may be used, however, might cause adverse effects on plant components. The potential for such impacts would have to be evaluated through long-term field testing conducted over time periods of several months or more."

[28] Footnote 24 reference at pages 30-32.

[29] Footnote 24 reference at pages 31-32, items 6 and 9, discussing injection of activated carbon and halogenated activated carbon, are the only items to highlight specific mercury removal levels, and fail to mention halogenated fuel additives or in-flight sorbent enhancement in the flue gas.

13. The EPA's failure to recommend the use of halogenated fuel additives in combination with injection of activated carbon into the flue gas to cause in-flight enhancement of the sorbent in the flue gas is particularly striking because my coinventors and I had already begun publishing results from initial testing of in-flight sorbent enhancement in the flue gas. The EPA acknowledged those results in their report, noting that 63% mercury removal was achieved, and specifically found that this approach is different from merely using pre-treated sorbent.[27] Nonetheless, despite having this initial data as a roadmap to arrive at the claimed invention, the EPA continued to espouse the conventional view in favor of pre-treated sorbents.

The Department of Energy Funds Research into In-Flight Sorbent Enhancement in the Flue Gas

14. Despite the EPA's optimism for injection of pre-treated halogenated carbon sorbents into the flue gas in the early 2000s, various research groups were pursuing alternative technologies during this time period. The EERC was one of those groups. After extensive research into methods for detecting and measuring mercury species, and some research into various sorbents, my co-inventors and I theorized that in-flight sorbent enhancement in the flue gas could provide an improvement over pre-treated sorbent.

15. The EERC obtained funding to test this theory in 2003 from the U.S. Department of Energy's National Energy Technology Laboratory (DOE/NETL) under the Office of Fossil Energy's Innovations for Existing Plants (IEP) Program.[30] The goal of Phases I and II of the program was development of Hg control technologies that could achieve 50 to 70% Hg capture at costs 25 to 50% less than the baseline 1999 estimate.[31] Our initial pilot-scale tests suggested that our approach could achieve mercury removal efficiencies

[30] T.J. Feeley III, J. Murphy, J. Hoffmann, S. A. Renninger, A Review of DOE/NETL's Mercury Control Technology R&D Program for Coal-Fired Power Plants, April 2003.
[31] Footnote 30 reference, page 3, second paragraph.

ranging from 50-90%. As a result, the EERC successfully obtained several multi-million-dollar awards under the program.[32]

In-Flight Sorbent Enhancement in the Flue Gas Is Finally Recognized as a Critical Advancement

16. It is estimated that over $60 million dollars was spent by the EERC on the research, development, testing, and demonstration of mercury removal from flue gas.[33] In 2008, DOE published a document highlighting the successful development and demonstration of the technology.[34] Some of the key advantages of the technology are highlighted as follows[34, 35]:

- Improves mercury oxidation and enhances activated carbon reactivity, which can improve capture in downstream equipment.
- Allows use of more abundantly available supplies of activated carbon (treated activated carbons have limited supply).
- Improves mercury capture while using far less activated carbon.
- Improves mercury capture efficiencies in some instances to greater than 90% (standard ACs can be limited to around 60%).
- Allows for performance and cost optimization of SEA and activated carbon at each site.
- Minimizes ESP particulate and opacity problems by using lower amounts of activated carbon.
- Minimizes fabric filter particulate emissions and pressure drop while allowing the unit to operate at maximum load by using lower amounts of activated carbon.

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[32] Footnote 30 reference, page 2, second paragraph; page 5 at Table 1; page 6 at Table 2; page 7 at Table 3; page 9, first full paragraph; page 13, last paragraph; page 17, last full paragraph; paragraph bridging pages 17-18; page 18, first full paragraph; and page 19, last partial paragraph.

[33] https://www.midwestemissions.com/

[34] U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, Cooperative Research and Development, "Successes: Sorbent Enhancement Additive Technology for Mercury Control", 2008

[35] A. P. Jones, J. W. Hoffmann, D. N. Smith, T. J. Feeley, J. T. Murphy, "DOE/NETL's Phase II Mercury Control Technology Field Testing Program: Preliminary Economic Analysis of Activated Carbon Injection," Environ. Sci. Technol., 2007, 41 (4), pp 1365–1371. DOI: 10.1021/es0617340, January 17, 2007.

In-Flight Sorbent Enhancement in the Flue Gas Experiences Commercial Success and Is Copied by Sidney Nelson and Other Competitors

17. One of the most straightforward indications of the success of the invention comes from chemical giant Albemarle, one of the largest suppliers of bromine worldwide. In 2008, Albemarle acquired Sidney Nelson's brominated sorbent company Sorbent Technologies Corp. and the Nelson patent.[36] Albermarle continued to market and sell brominated carbon sorbents. Nonetheless, today, even Albemarle now sells chemicals and systems for in-flight sorbent enhancement in the flue gas.[37]

18. In fact, even Mr. Nelson himself ultimately accepted the benefits of in-flight sorbent enhancement in the flue gas. In a post-Albemarle acquisition presentation entitled "How China Can Leapfrog the World in Mercury Emission Reduction", he noted that pre-treated sorbents were accepted in the U.S., but he recommended that Chinese operators should instead use in-flight sorbent enhancement in the flue gas.[38] As his basis for proposing that new approach he did not cite his own research or some commonly understood reference or theory from the 1990s or early 2000s. Rather, he relied on data collected by myself and my colleagues at the EERC and published in 2006.[39]

19. Despite the initial success of pre-treated sorbents, in-flight sorbent enhancement in the flue gas has more recently experienced important growth in the U.S. EPA data indicates that in-flight sorbent enhancement in the flue gas is currently used by more than

[36] See, U.S. assignment database for U.S. patent no. 6,953,494, assigned to Sorbent Technologies Corporation on 9/18/2006, and assigned to Albemarle Corporation on 9/30/2010. See also, http://www.chemeurope.com/en/news/85387/albemarle-corporation-acquires-sorbent-technologies-corporation.html.
[37] https://www.albemarle.com/businesses/bromine-specialties/bromine-&-derivatives/mercury-control, at the "ADDITIVES" tab.
[38] https://www.dri.edu/images/stories/editors/leapfrog/techprog/IId_3_NelsonJr.pdf at slide 24.
[39] Footnote 38 reference at slide 20.

one-third of all plants in the U.S.,[40] and it has been recognized as one of the key technologies enabling cost effective mercury removal from coal plant exhaust.

20. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and/or any patent issued thereon.

Dated: March 20, 2019 By: / John Pavlish /

John Pavlish

[40] EPA Air Markets Program Data: https://ampd.epa.gov/ampd/. From this webpage, the "Query" tab was clicked. For programs and data sets, the program "mercury and air toxics standards (MATS)" and the data set "facility attributes" were selected, and then "next step" was clicked. For time frame, "select a range" was selected from 2019 to 2019, and then "next step" was clicked. For criteria, nothing was selected, and then "next step" was clicked. For variables, only the variables "owner", "fuel type (primary)", and "mercury controls" were selected, and then "next step" was clicked. The CSV file was downloaded, and then the "facility" file was opened as an Excel spreadsheet. The data was sorted to include only coal plants, column G, which totaled 606. Column H was then sorted to include only additives to enhance PAC; the total number was 70. Column H was then sorted to include only the units that had actually filled out what mercury control technology they are using, which totaled 228. Assuming that the 228 units are a random sampling of the 606 total, that number statistically represents all of the units and the distribution of different mercury control approaches. Thus, if 70 units are using coal additives with PAC and 228 units are representative of the 606, about 1/3 (e.g., 70/228 = 0.31) of the units are using coal additives with PAC.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

PETITION FOR A THREE-MONTH EXTENSION OF TIME

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

In accordance with the provision of 37 C.F.R § 1.136(a), it is respectfully requested that a three-month extension of time be granted in which to respond to the Final Office Action mailed January 14, 2019, said period of response being extended from April 14, 2019 to July 14, 2019.

Please charge Deposit Account No. 19-0743 in the amount of $1,400.00 to cover the required extension fee. Please charge any additional fees or credit overpayment to deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date July 10, 2019

By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

Document code: WFEE

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PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/974,343	Filing Date 05/08/2018	☐ To be Mailed

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), (l), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	05/15/2018	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	07/10/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 29	Minus	** 23	= 6		x $100 =	600
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	600

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/LAN M DONG/
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The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

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(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15974343
	Filing Date	2018-05-08
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9

	1	"Application Serial No. 15 589,359, Response filed 04-30-19 to Final Office Action mailed 03-01-19", 11 pgs.
	2	"Application Serial No. 15 589,359, Final Office Action mailed 03-01-19", 10 pgs
	3	"Control of Mercury Emissions from Coal Fired Electric Utility Boilers: An Update", US EPA Air Pollution Prevention and Control Division, National Risk Management Research Laboratory, Office of Research and Development, (February 18, 2005), 59 pgs
	4	"Sorbent Enhancement Additives for Mercury Control", US DOE Office of Fossil Energy, National Energy Technology Laboratory, (June 2008), 4 pgs
	5	"Application Serial No. 15 978,760, Ex Parte Quayle Action mailed 04-19-19", 13 pgs
	6	"Application Serial No. 15 295,594, Response filed 4-23-19 to Non Final Office Action mailed 10-23-18", 45 pgs
	7	"Application Serial No. 15 978,760, Response filed 4-23-19 to Ex Parte Quayle Action mailed 04-19-19", 15 pgs
	8	"Application Serial No. 15 978,760, Notice of Allowance mailed 05-08-19", 7 pgs
	9	"Coal Combustion Products (CCPs): Characteristics, Utilization and Beneficiation", Edited by Tom Robl, et al., Woodhead Publishing (Elsevier), (2017), 565 pgs
	10	"Application Serial No. 15 589,359, Advisory Action mailed 05-22-19", 3 pgs
	11	"Application Serial No. 15 382,114, Response filed 3-12-19 to Non Final Office Action mailed 12-12-18", 24 pgs

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15974343
	Filing Date	2018-05-08
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9

	12	"Application Serial No. 15 978,760, Response filed 03-20-19 to Final Office Action mailed 12-26-18", 90 pgs.
	13	BENSON, STEVEN A., "JV Task 73 - Mercury Control Technologies for Electric Utilities Burning Subbituminous Coals - Draft Final Report", University of North Dakota Energy and Environmental Research Center, (June 2005), 165 pgs
	14	BENSON, STEVEN A., "Pilot-and Full-Scale Demonstration of Advanced Mercury Control Technologies for Lignite-Fired Power Plants", University of North Dakota Energy and Environmental Research Center, (February 2005), 97 pgs
	15	BERRY, MARK, "Mercury control evaluation of calcium bromide injection into a PRB-fired furnace with an SCR", Proc. of the Air Quality VI Conference, Arlington, VA, (2007), 9 pgs
	16	BROWN, THOMAS D., "Mercury Measurement and Its Control: What We Know, Have Learned, and Need to Further Investigate", Journal of the Air and Waste Management Association, 49(6), (June 1999), 98 pgs
	17	FEELEY, THOMAS J., "A Review of DOE NETL's Mercury Control Technology R and D Program for Coal-Fired Power Plants", DOE NETL Hg R and D Program Review, (April 2003), 32 pgs
	18	FRENCH, CHARLES L., "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units - Final Report to Congress: Volume 1", US EPA Office of Air Quality Planning and Standards, (February 1998), 502 pgs
	19	GHORISHI, BEHROOZ S., "In-Flight Capture of Elemental Mercury by Chlorine-Impregnated Activated Carbon", Proc. of the 94th Annual Meeting of the Air and Waste Management Association, Orlando, FL, (June 2001), 14 pgs
	20	JONES, ANDREW P., "DOE NETL's Phase II Mercury Control Technology Field Testing Program: Preliminary Economic Analysis of Activated Carbon Injection", Environmental Science and Technology, 41(4), (2007), 7 pgs
	21	KEATING, MARTHA H., "Mercury Study Report to Congress Volume 1: Executive Summary", US EPA Office of Air Quality Planning and Standards, (December 1997), 95 pgs
	22	KILGROE, JAMES D., "Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report", US EPA Office of Research and Development, National Risk Management Laboratory, Air Pollution Prevention and Control Division, (December 2001), 485 pgs

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	Filing Date	2018-05-08
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9

	23	NELSON, SID JR., "How China Can Leapfrog the World in Mercury Emission Reductions", Proc. of the AWMA Intl. Specialty Conference on Leapfrogging Opportunities for Air Quality Improvement, (2010), 24 pgs
	24	PAVLISH, JOHN H., "Status review of mercury control options for coal-fired power plants", Fuel Processing Technology, Vol. 82, (2003), 77 pgs
	25	YANG, YANG, "Effect of HBr formation on mercury oxidation via CaBr(2) addition to coal during combustion", RSC Advances, 6(64), (2016), 7 pgs

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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.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15974343
Filing Date	2018-05-08
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.001US9

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

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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	/Nicholas P. Lanzatella/	Date (YYYY-MM-DD)	2019-05-23
Name/Print	Nicholas P. Lanzatella	Registration Number	63,803

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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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.

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	David L. Buck/Jamie Johnson
Attorney Docket Number:	4820.001US9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

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EFS ID:	36099231
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	David L. Buck/Jamie Johnson
Filer Authorized By:	David L. Buck
Attorney Docket Number:	4820.001US9
Receipt Date:	23-MAY-2019
Filing Date:	08-MAY-2018
Time Stamp:	15:04:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
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12	Non Patent Literature	0011_2_npl_benson_subbitum inous_coals_2005_f.pdf	4821773 fd4ac7842a154eca6f187385eb1bfea6d527 4c77	no	165
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14	Non Patent Literature	0013_2_npl_brown_mercury_measurement_2011_f.pdf	1949189 e2c69a3b171d5136d87bf89d5808b5e3d5e60774	no	98
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Image File Wrapper and may affect subsequent processing					
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20	Non Patent Literature	0019_2_npl_ghorishi_inflight_2001_f.pdf	189025 016a8bdeb94fc316b16b681528cceec5eca695ce	no	14
Warnings:					
Information:					
21	Non Patent Literature	0020_2_npl_jones_doe_netl_phase2_hg_2007_f.pdf	220901 ccf0c322a6299d4831b2917ef0824dd03f09913e	no	7
Warnings:					
Information:					
22	Non Patent Literature	0021_2_npl_keating_epa_mercury_study_1997_f.pdf	943771 806d6eb72efc7c26e7ccba973612491d5659ea6e	no	95
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
23	Non Patent Literature	0022_2_npl_kilgroe_epa_mercury_interim_report_2002_f.pdf	6484898 0537df50eba1eabceaacb80aaf7a39845484fb5e	no	485
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
24	Non Patent Literature	0023_2_npl_nelson_china_emissions_2010_f.pdf	2799675 b3956939e57cbcee73f76d51992ebbcae0620081	no	24
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
25	Non Patent Literature	0024_2_npl_pavlish_status_review_2003_f.pdf	907898 8a4236587218af8687cd4c36fbf854d2095cb0cf	no	77
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					

Information:					
26	Non Patent Literature	0025_2_npl_yang_hbr_hg_oxidation_2016_f.pdf	625919 1117fb6a7e90c33926cd18ee0f71ec6ecf0a8f14	no	7
Warnings:					
Information:					
27	Fee Worksheet (SB06)	fee-info.pdf	30746 2900cb3a15d98cf173d866c6b2f82537779 5f5ed	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	52956593	

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.

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20190009247A1	1/10/2019	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-19-18", 28 pgs	
	"Application Serial No. 14/712,558, Final Office Action mailed 01-11-19", 27 pgs	
	"Application Serial No. 15/382,114, Non Final Office Action mailed 12-12-18", 46 pgs	
	"Application Serial No. 15/589,359, Amendment and Response filed 01-17-19 to Non Final Office Action mailed 10-22-18", 14 pgs	
	"Application Serial No. 15/978,760, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-10-18", 25 pgs	
	"Application Serial No. 15/978,760, Final Office Action mailed 12-26-18", 21 pgs	
	"Application Serial No. 15/997,091, Final Office Action mailed 01-11-19", 20 pgs	
	"Application Serial No. 15/997,091, Response filed 12-03-18 to Non Final Office Action mailed 11-02-18", 40 pgs.	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	David L. Buck/Jamie Johnson
Attorney Docket Number:	4820.001US9

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	35253743
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	David L. Buck/Jamie Johnson
Filer Authorized By:	David L. Buck
Attorney Docket Number:	4820.001US9
Receipt Date:	26-FEB-2019
Filing Date:	08-MAY-2018
Time Stamp:	14:14:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	022719INTEFSW00000473190743
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		15974343_SIDS_02-26-2019.pdf	265353 490d7146837220f4e832c7e31db0c0fbdb3b9065	yes	5
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Miscellaneous Incoming Letter		1	1	
	Miscellaneous Incoming Letter		2	2	
	Transmittal Letter		3	4	
	Information Disclosure Statement (IDS) Form (SB08)		5	5	
Warnings:					
Information:					
2	Non Patent Literature	0001_2_npl_4820001u10_foar_01112019_f.pdf	891808 eef9f3bba7b182a0b361e8e8bbf4876dca68d873	no	20
Warnings:					
Information:					
3	Non Patent Literature	0002_2_npl_4820001u10_response_f.pdf	915746 95f4c32ca7327d46d8b5c307b1a7b72001c74600	no	40
Warnings:					
Information:					
4	Non Patent Literature	0003_2_npl_4820001us7_aarn_120318_f.pdf	645370 bbdb250afc40b03034dc8cef37a67110dd80ec32	no	28
Warnings:					
Information:					

5	Non Patent Literature	0004_2_npl_4820001us7_foar_01112019_f.pdf	1277410 fca3bd30b1f05fbe88deb5b1bba54aa4efb3261e	no	27
Warnings:					
Information:					
6	Non Patent Literature	0005_2_npl_4820003us2_aarn_011719_f.pdf	177621 2432999443c37999c81d89bac307749e3c821db3	no	14
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_4820004us1_oarn_12122018_f.pdf	1799080 97a34b05a884e8ef5517dd7e1fcfa9e7508113d8	no	46
Warnings:					
Information:					
8	Non Patent Literature	0007_2_npl_4820007us4_foar_12262018_f.pdf	1010863 7c986114a2bdb79239ffb00d1c029aec56e71a67	no	21
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_4820_007us4_aarn_120318_f.pdf	637752 8396e7d3f170b5e1769183ca6a1601dc301b488f	no	25
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	30746 c265bcd46fa7d5b24ad92a7f73a1e39a21dfc2ee	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7651749		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	N/A
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Communication Concerning Prior and Copending Applications (1 pg.)
X Supplemental Information Disclosure Statement **Pursuant to 37 C.F.R. § 1.97(d)(1) and 37 C.F.R. § 1.97(e)(2)** (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (8).
X Authorization to charge Deposit Account 19-0743 in the amount of $240.00 to cover the fee for consideration of Information Disclosure Statement under 37 C.F.R. § 1.97(c).

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION CONCERNING PRIOR OR COPENDING APPLICATION(S)

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

Pursuant to the guidance of MPEP §§ 2001.06(b) and 2004(9), Applicant would like to bring the following additional application(s) to the Examiner's attention. The identification of these applications is not intended to suggest that the subject matter claimed in any listed application is, or has been, substantially similar to any claim or claims in the present application.

Serial No./ Patent No.	Filing Date	Attorney Docket	Title
15/997,091	June 4, 2018	4820.001U10	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
16/130,670	September 13, 2018	4820.005US2	SORBENT COMPRISING CARBON AND NITROGEN AND METHODS OF USING THE SAME

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 02/26/2019 By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Amber Orlando
Serial No.:	15/974,343	Group Art Unit:	1776
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R §1.97(e)(2)

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(d)(1) and 37 C.F.R. § 1.97(e)(2), Applicant states that no item of information contained in the Supplemental Information Disclosure Statement was cited in any communication from a foreign patent office in a counterpart foreign application and that no item of information contained in the Supplemental Information Disclosure Statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

Pursuant to 37 C.F.R. § 1.97(d)(2), Applicant hereby authorizes the Commissioner to charge the fee of $240.00 as set forth in 37 C.F.R. § 1.17(p), to Deposit Account No. 19-0743. Please charge any additional fees or deficiencies, or credit any overpayment to Deposit Account No. 19-0743.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no

longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date 02/26/2019 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:jj

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.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 01/14/2019

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
01/14/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Office Action Summary	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA 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 12/03/2018.

☐ 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) 1-10,14 and 21-26 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) 1-10,14 and 21-26 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 _____ 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 following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the

contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

Claim 1-3 and 5-8, 14 and 21-26 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 in view of Nelson Jr. US 2004/0003716.

For claims 1 and 26, the Felsvang et al. reference discloses a method for separating mercury from a mercury-containing gas, the method comprising: combusting a mixture of coal and an additive that has been added to the coal to form the mercury-containing gas (column 5, lines 23-25, lines 60-65 and column 4, lines 42-45) wherein the combusting of the mixture is performed at a coal combustion facility site (column 4, lines 39-47), adding a particulate sorbent material comprising activated carbon into the mercury-containing gas (column 6, lines 11-14 and lines 24-26); promoting at least a portion of the particulate sorbent material by reacting the sorbent material with a promoter in-flight in a gas stream at the coal combustion facility site comprising contacting the particulate sorbent material dispersed in the gas stream with the promoter to form a promoted sorbent material; (column 4, lines 5-15 and column 4, lines 42-45 and the figure) capturing reacting mercury in the mercury-containing gas with the sorbent material, to form a mercury-sorbent (column 6, lines 24-28); and separating the mercury-sorbent from the mercury-containing gas (column 5, lines 57-65). The reference does not disclose the additive comprising a bromide compound, Br_2, HBr and Br^-, promoting at least a portion of the sorbent material by chemically reacting the sorbent material with a promoter that comprises HBr, Br^- or a combination thereof, to form a promoted sorbent material.

The Nelson reference discloses the additive comprising a bromide compound, Br_2, HBr and Br^- and promoters including HBr, Br^- or a combination thereof (Nelson paragraphs [0017] and [0041]).

It would have been obvious to one having ordinary skill in the art to have modified the Felsvang et al. reference to either replace the Cl promoter/additive with or include in addition to the Cl promoter/additive, with an additive comprising a bromide compound, Br_2, HBr and Br^- and promoters including HBr, Br^- or a combination thereof (Nelson paragraphs [0017] and [0041]) so as to provide an effective carbon sorbent for mercury.

The combination of references above would result in promoting at least a portion of the sorbent material by chemically reacting the sorbent material with a promoter (as shown in Felsvang et al. above) that comprises HBr, Br^- or a combination thereof (as shown in Nelson above), to form a promoted sorbent material promoting (as shown in Felsvang et al. above). The examiner also points to Felsvang et al. which discloses that the halogen and the activated carbon exhibit a synergistic effect enabling an extremely efficient Hg removal (column 6, lines 8-11).

For claim 2, the Felsvang reference discloses mixing the additive and the coal before combusting the coal (column 4, lines 42-45).

For claim 3, the Nelson reference discloses the additive mixed with the coal is in a liquid (paragraph [0064]).

For claims 5 and 6, and as detailed above, each of the claimed steps is disclosed by the combination of Felsvang and Nelson reference and therefor the result of performing the steps would inherently be the same and would result in the promoted sorbent material comprises active sites, wherein the active sites comprise halide anions bound to the activated carbon and the promoted sorbent material comprises active sites, wherein the active sites comprise carbocations bound to halide anions.

For claims 7 and 8, the promoted sorbent is disclosed by the combination of Felsvang and Nelson as disclosed above. Each of the steps as claimed are also disclosed by Felsvang and Nelson and would inherently have the same results when the method is performed i.e. chemically reacting the

sorbent material with the additive in the mercury-containing gas comprises chemically reacting carbene species edge sites in the activated carbon with the additive and carbocations in the activated carbon of the mercury-sorbent accept electrons from mercury atoms of the mercury-sorbent.

For claim 14, the Felsvang et al. reference discloses the activated carbon is chosen from powdered activated carbon, granular activated carbon, carbon black, carbon fiber, aerogel carbon, pyrolysis char, and combinations thereof (column 3, lines 5-23).

For claim 21, the Felsvang et al. reference discloses that the coal and the additive are mixed prior to the combustion step as well as the combustion furnace where combustion occurs (column 3 lines 43-47 and column 4, lines 23-26). The examiner asserts that this would include coal and the additive being mixed at a location upstream of a combustion furnace where combustion occurs. Further while the reference does not explicitly state "at a location upstream of the combustion furnace" it would be well within the level of ordinary skill in the art to modify the Felsvang et al. reference to include the coal and the additive being mixed at a location upstream of the combustion furnace as this does not fundamentally change the reaction step and is merely a rearrangement of parts/steps.

For claims 22 and 23, the Felsvang et al. reference discloses separating greater than 70 wt% of the mercury from the mercury-containing gas on the sorbent (examples 1, 3 and 4). Further the examiner asserts that these limitations are the result of the method. As the method is disclosed by Felsvang et al. and Nelson as shown above, the result of such a combination would occur i.e. separating greater than 70 wt% of the mercury from the mercury-containing gas on the sorbent.

For claim 24, the Felsvang et al. reference does not explicitly state the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon. The reference does disclose optimizing the amount of Cl and activated carbon introduced (column 6, lines 42-46).

Further the Nelson reference also discloses optimizing of additive so as to obtain a desired mercury reactivity (paragraph [0054]).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Felsvang et al. reference to include state the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon (Felsvang et al. column 6, lines 42-46 and Nelson paragraph [0054]) so as to adjust the amount of halogen introduced based on the Hg content and to ensure optimum reaction between the halogen and the activated carbon. Further the courts have held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

For claim 25, the Felsvang et al. reference discloses the method is a method for reducing mercury in the mercury-containing gas to a desired level, wherein separating the mercury-sorbent from the mercury-containing gas forms a cleaned gas (column 5, lines 45-50), the method further comprising: monitoring the mercury content of the cleaned gas; and controlling, in response to the monitored mercury content of the cleaned gas, an introduction rate (amount would include introduction rate) of the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that, the mercury content of the cleaned gas is maintained at or below the desired level (column 6, lines 42-47).

The Felsvang et al. reference does not disclose injection as a means of introduction.

The Nelson reference discloses injection (abstract).

It would have been obvious to one having ordinary skill in the art to modified Felsvang et al. to have the means of introduction be injection (Nelson abstract) so as to allow for the components of the system to be entered into the system.

Claim 4 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716 as applied in claim 3 above and further in view of Srinivasachar et al. US 6,848,374.

For claim 4, the Felsvang and Nelson combination does not disclose the liquid is a hydrocarbon, a chlorinated hydrocarbon, supercritical carbon dioxide water, salt solution, or a combination thereof.

The Srinivasachar et al. reference discloses the liquid is a salt solution (column 6, lines 5-10).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Felsvang and Nelson combination to include the liquid is a salt solution (Srinivasachar et al. column 6, lines 5-10) so as to allow the halogen to be sprayed and therefore deposited on the sorbent particles.

Claim 9 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716 as applied in claim 1 above and further in view of Srinivasachar et al. US 6,848,374.

For claim 9, the Felsvang and Nelson combination does not disclose wherein the additive is substantially in vapor form in the mercury-containing gas.

The Srinivasachar et al. reference discloses wherein the additive is substantially in vapor form in the mercury-containing gas (column 6, lines 13-18).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Felsvang and Nelson combination to include wherein the additive is substantially in vapor form in the mercury-containing gas (Srinicasachar et al. column 6, lines 13-18) so as to allow the halogen to deposited on the sorbent particles via condensing/adsorbing.

Claim 10 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716 as applied in claim 1 above and further in view of Gadkaree US 6,136,749.

The combination of Felsvang et al. and Nelson do not disclose the additive comprises Ca, Na, or a combination thereof.

The Gadkaree reference discloses the additive comprises Ca, Na, or a combination thereof (column 3, lines 58-65 and claim 10).

It would have been obvious to one having ordinary skill in the art to have modified the Felsvang et al. and Nelson combination to include the additive comprises Ca, Na, or a combination thereof (Gadkaree column 3, lines 58-65 and claim 10) so as to enhance the activity of the activated carbon catalyst.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file

provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. US 7,435,286 ('286) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '286 except for combusting a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '286 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-25 of U.S. Patent No. US 8,168,147 ('147) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '147 except a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '147 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-60 of U.S. Patent No. US 8,512,655 ('655) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '655 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '655 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65

and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-60 of U.S. Patent No. US 8,821,819 ('819) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '819 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '819 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-33 of U.S. Patent No. US 9,757,689 ('689) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '689 except combusting a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '689 reference to include combusting a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of U.S. Patent No. US 9,468,886 ('886) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '886 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '886 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. 8,652,235 ('235) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '235 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '235 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of copending Application No. 15/295594 ('594) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '594 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '594 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson

paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 8-20 of copending Application No. 15/589359 ('359).

Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording it the limitations correspond to '359.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/853029 ('029) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '029 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '029 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 14/712558 ('558) Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording it the limitations correspond to '558.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/951970 ('970). Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording, the limitations correspond to '970.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/382114 ('114) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '114 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '114 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/853029 ('029) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '029 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '029 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-26 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/978,760 ('760) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '760 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '760 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Response to Arguments

Applicant's arguments filed 12/03/2018 have been fully considered but they are not persuasive.

I. The 112 rejection of claims 1, 7 and 23-25 has been overcome by the claim amendment.

II A. The applicant traverses the combination of Felsvang and Nelson combination stating that there is no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process. The applicant contends that one having ordinary skill in the art would not be motivated to replace Felsvang's chloride-treatment with treatment by another material as the prior art does not disclose the bromide additives performing the same or better mercury-removal efficiency.

The examiner disagrees. See Fig. 14 of Nelson which shows that about 3 times the amount of chlorine treated PAC was required to achieve the same degree of mercury removal as with bromine. (paragraph [0085]). Also see the absorption rate in the table on page 8. Further as the rejection above states. Both chlorine and bromine are known within the art to treat activated carbon and therefore it would be well within the capability of one having ordinary skill in the art to *either replace the Cl with or include in addition to* the halogen or halide promoter comprising HBr, Br^-, or a combination thereof to promote activated carbon (Nelson paragraphs [0017] and [0041]) so as to provide an effective carbon sorbent for mercury.

The applicant contends that the Nelson reference does not disclose HBR and Br^- being more effect with activated carbons than chlorides.

The examiner disagrees. The Nelson reference discloses that HBr is used to provide bromide to the system. Example 5, paragraph [0083] states that the brominated PACs were treated with HBr or Br_2. Figures 14 and 15 disclose that HBr treated PAC performs better than chlorine treated PAC. Further one having ordinary skill in the art would expect PAC treated with HBr or Br_2 would result in a very similar modified PAC as they both include bromide (see paragraph [0092] which discloses that each of the brominated PACs performed similarly). The examiner also points to paragraph [0087] of Nelson which discloses that PAC adsorption of gaseous hydrogen bromide being ten times faster than it was for chlorine.

II(8)(1). The applicant contends that the bromide promoters are more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas. The applicant further provides a graph to demonstrate these unexpected results.

These unexpected results are not commensurate with the scope of the claims. The applicant is claiming HBr and Br^- while the graph only demonstrates HBr. Further the comparisons between the prior art and that of the current invention do no demonstrate unexpected results. The applicant's data is unclear as it is either HBr (as specified in the actual graph) or NaBr (as specified in the legend). Further the 18.2 data point has no labeling on what the promoter is. None of the data point include what amount is being specified, wt%, vol% etc. The results would be expected by one having ordinary skill in the art as the wt% (if we are to assume the amount specified is wt) of the amount supported on the upper most line is greater than that of the wt% on the middle trending line. Further claim 1 does not include NaBr on coal. Lastly is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods.

The second graph on page 14 comparing NaBr on coal to HBr treated AC and it is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods. To do that the graph would have to be comparing HBr in the present method to HBr is the prior art method. Further the applicant has not shown the amount of promoter supported by each (wt%) data point. Lastly claim 1 does not include NaBr on coal.

The third graph on page 15 compares HBr treated AC and NaBr on coal with AC injected into flue gas. The graph states Milligram of HBr/MMacF/1%Hg Removed. As HBr is not a part of the current application data points it is unclear how to interpret this graph. Claim 1 does not include NaBr on coal. Further is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods.

II(B)(2). The applicant contends that there is no way a person of ordinary skill in the art could predict from the cited references that in-flight promotion of a sorbent with bromide promoters is more effective for mercury removal.

The examiner contends that the applicant has not established that it is more effective.

II(C)(1). The applicant contends that one having ordinary skill in the art would not have predicted in-flight chloride promotion of activated carbon to be more effective for mercury removal that in-fligh chloride promotion.

The examiner disagrees. Nelson discloses that bromide is a better promoter of AC for the purpose of mercury removal as shown above. Therefore one having ordinary skill in the art would expect an inflight bromide promoted sorbent to superior to and inflight chloride promoted sorbent.

II(C)(2). The applicant argues that one having ordinary skill in the art would not predict this advantage from the cited references.

The examiner disagrees for the reasons stated above.

II(D)(2). The applicant contends that "Even if a person of ordinary skill in th art compared the mercury removal of Felsvang's activated carbons promoted with Chloride in the flue gas to activated carbond treated with HCL outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties".

This appears to be merely conjecture by the applicant as no factual evidence has been presented.

The graphs on pages 20 and 22, has NaCl compared to HCl. It is unclear if the results are because of the different components being reacted or because of the different method being used. In order to establish that the method being used has unexpected results the components used must be the same for both methods. Further the examiner points to the y-axis which has HCl which is not included in one set (NaCl) of the data points so it is unclear how the data points are being obtained.

The applicant contends that using activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas containing bromide pormoters for in-flight promosotion results in greater mercury removal than using activated carbon only treated with bromide additives.

The results shown only described HCl and Br_2, HCl not being within the current claim set and Br_2 not encompassing each of the limitations claimed. Therefore the results shown are not commensurate with the scope of the claim. Further the results shown in the Mercury Vapor Species at ESP Outlet and %Hg Removal, disclose NaBr and NaCl, which is not claimed. Lastly the assertion is not commensurate with the scope of the claim as activated carbon treated with bromide additives outside the flue gas is not being claimed. Further the examiner asserts that merely adding more bromide to the activated carbon to produce more Hg removal would be expected as a great amount of bromide added to activated carbo results in greater Hg removal (Nelson paragraph [0054]).

Response to Amendment

The Declaration under 37 CFR 1.132 filed 12/03/2018 is insufficient to overcome the rejection of claims based upon pre-AIA 35 U.S.C 103(a), Felsvang et al. US 5,435,80 in view of Nelson Jr. US 2004/0003716 as set forth in the last Office action because: the facts presented are not germane to the rejection at issues and the showings are not commensurate in scope with the claims.

Sections 2-5 details experimental parameters.

Section 5 and 6 detail data comparing NaBr on coal and injectin untreated activated carbon into the flue gas, placing NaBr on the coal and injecting 5% wt HCl outside the flue gas provided greater mercury removal.

The results shown only described HCl and Br_2, HCl not being within the current claim set and Br_2 not encompassing each of the limitations claimed. Therefore the results shown are not commensurate with the scope of the claim. Further the results shown in the Mercury Vapor Species at ESP Outlet and %Hg Removal, disclose NaBr and NaCl, which is not claimed.

Further the appellant contends that injecting activated carbon into the flue gas treated with Br_2 outside the flue gas compared to NaBr on the coal an injecting activated carbon into the flue gas treated with Br_2 outside the flue gas provided greater mercury removal, the latter having a greater removal rate than the former being unexpected.

The examiner disagrees. the examiner asserts that merely adding more bromide to the activated carbon to produce more Hg removal would be expected as a great amount of bromide added to activated carbo results in greater Hg removal (Nelson paragraph [0054]).

Sections 7-9 detail using NaBr on coal with injection of the HCl-treated active carbon and with injection of the HCl activated carbon from the procedure at item 3 without NaBr on coal. Section 9 asserts that NaBr on the coal and injecting activated carbon into the flue gas treated with HCl outside

the flue gas provided greater mercury removal that that of only activated carbon without NaBr injected into the flue gas stream and then treated with HCl.

Again the examiner asserts that this is not unexpected as it was known within the prior art to add more additives/promoters so as to remove more mercury. See Nelson and Felsvang et al both of which detail adding more Bromine and/or Chlorine for greater removal of mercury. Further the results shown detail NaBr and HCl which are not currently claimed and therefore the results shown are not commensurate with the scope of the claim.

Sections 10-12 detail experimental parameters.

Section 14 details that compared to placing NaBr on coal and injecting untreated activated carbon into the flue gas, placing NaBr on coal and injected activated carbon into the flue gas treated with Br_2 outside the flue gas provided greater mercury removal.

The examiner asserts that this is not unexpected as it was known within the prior art to add more additives/promoters so as to remove more mercury (see Nelson above). Further the results shown are not commensurate with the scope of the claims as NaBr is not claim and the process of placing NaBr on coal and injected activated carbon into the flue gas treated with Br_2 outside the flue gas is not claimed.

Sections 15-16 detail experimental parameters.

Section 17 details comparing placing NaCl on coal and injected untreated activated carbon into the flue gas and placing NaCl on the coal and injected activated carbon into the flue gas treated with HCl outside the flue gas provided greater mercury removal.

The examiner asserts that this is not unexpected as it was known within the prior art to add more additives/promoters so as to remove more mercury. See above which details Felsvang et al above which discloses multiple injection points of HCl as well as in-flight promotion. In fact the entire point of Felsvang is that increasing the amount of Cl within the gas stream by whatever means increases the

mercury removal (column 3, lines 56-66). Further the results shown are not commensurate with the scope of the claims as NaCl and HCl are not claimed.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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 date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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.

AMBER ROSE. ORLANDO
Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO
Inventor Search (EAST)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	01/07/2019	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Modified form PTO/SB/08A(04-07) OMB 651-0031
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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,130,930	11/20/2018	Olson, Edwin S
	US-20180229182A1	8/16/2018	Olson, Edwin S., et al.
	US-20180280870A1	10/4/2018	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Non Final Office Action mailed 10-19-18", 26 pgs	
	"Application Serial No. 14/712,558, Non-Final Office Action mailed 10-19-18", 35 pgs	
	"Application Serial No. 14/712,558, Response filed 08-14-18 to Non Final Office Action mailed 07-02-18", 11 pgs	
	"Application Serial No. 15/295,594, Non Final Office Action mailed 10-23-18", 20 pgs	
	"Application Serial No. 15/382,114, Response filed 09-12-18 to Restriction Requirement mailed 08-28-18", 8 pgs.	
	"Application Serial No. 15/382,114, Restriction Requirement mailed 08-28-18", 9 pgs	
	"Application Serial No. 15/589,359, Final Office Action mailed 09-12-18", 14 pgs	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 10-22-18", 12 pgs	
	"Application Serial No. 15/589,359, Response filed 09-14-18 to Final Office Action mailed 09-12-18", 18 pgs.	
	"Application Serial No. 15/978,760, Non Final Office Action mailed 10-10-18", 17 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 11-02-18", 27 pgs	
	"Application Serial No. 15/997,091,Response filed 08-14-2018 to Non Final Office Action mailed 07-27-18", 10 pgs	
	PIETRZAK, et al., "Preparation of nitrogen-enriched activated carbons from brown coal", Energy and Fuels 20.3, (2006), 1275-1280	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 01/07/2019

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	45	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S2	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorben and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S3	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:20
S7	73	("20020150516" | "4786483" | "5409522" | "5505766" | "6383981" | "6878358" | "20020033097" | "4530765" | "5346674" | "6080281" | "4708853" | "6027551" | "6136072" | "6258334" | "6818043" | "20060057044" | "20080207443" | "20010002387" | "3826618" | "4814152" | "4820318" | "4889698" | "5891324" | "6528030" | "20050227146" | "5419834" | "7942566" | "20080134888" | "3662523" | "3849267" | "4196173" | "4500327" | "6942840" | "20020134242" | "20030136509" | "20050147549" | "20060112823" | "20080134888" | "6471936" | "20010003116" | "20050019240" | "20060048646" | "4956162" | "5575982" | "6372187" | "6375909" | "7435286" | "7514052" | "20050074380" | "20090081092" | "5288306" | "1984164" | "4101631" | "5695726" | "6080281" | "6848374" | "20050000197" | "5300137" | "5607496" | "5672323" | "6214304" | "6953494" | "5245120" | "20070168213" | "7938571" | "20040003716" | "20040013589" | "3194629" | "3786619" | "5827352" | "20040109800" | "20070295347" | "5435980" | "6136749" | "20030206846").PN.	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:25
S8	13	"11209163"	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S9	3	"11209163" and non carbon	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S10	161	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:49
S11	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50

		sorbent and promoter and activated carbond and mercury				
S12	116	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S13	172	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S14	67	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S15	67	"6136749"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:11
S16	20	"684374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S17	1	"20040003716"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S18	68	"6848374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S19	41	"7435286"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S20	13	"8168147"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S21	69	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S22	181	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S25	28	"5266280"	US-PGPUB; USPAT	ADJ	ON	2016/06/07 13:41
S26	281	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:01
S27	148	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:02
S28	159	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:18
S29	206	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2016/09/29 16:22

		activated carbon	EPO; JPO; DERWENT; IBM_TDB			
S30	195	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/09/30 13:48
S33	6	"20040003719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:56
S34	49	"2004003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:57
S35	81	"6848374"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:58
S36	56	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:02
S37	7	olson.in. and ("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:04
S38	0	("40" microns and halocarbon sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S39	0	(halocarbon sorbent).clm. and "40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S40	65	"40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2016/11/16 11:06

			DERWENT; IBM_TDB			
S41	3907	("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S42	29	("40" microns and sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S43	1	(halocarbon sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S44	36	(sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S45	0	(sorbent).clm. and olson.in. and "40" micron	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S46	17	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:09
S47	2	"20110233133"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:27
S48	7	"20110023427"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:28
S49	15	"2004025274"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2016/11/16 11:32

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S50	11	"20040025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S51	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S52	40	"6312489"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S53	30	("20030024872" | "20050045553" | "20050144916" | "4008060" | "4640779" | "4655921" | "4673503" | "4738778" | "4746432" | "4799944" | "5043000" | "5051118" | "5120296" | "5174896" | "5320657" | "5512075" | "5674302" | "6152979" | "6312489" | "6315130" | "6336946" | "6398836" | "6585793" | "6598749" | "7648546").PN. OR ("7931723").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:36
S54	33	("4200444" | "4640779" | "5968215" | "6059851").PN. OR ("6312489").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:40
S55	5	"8518142"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:54
S56	4	"8747505"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:57
S57	2	"14318270"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 12:06
S58	13	pac with size with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 12:13
S59	197	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/11/16 15:23
S60	0	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10,	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39

		B01D53/10).cpc. and (halogen or halide of HBr) with sorbent "4198388"				
S61	10	"4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S62	0	"2010083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S63	2	"20100083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S64	2	absorp$5 with mea with methanol with acid	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:36
S65	2	"20070283813"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:39
S66	21	"4469596"	US-PGPUB; USPAT	ADJ	ON	2016/11/21 08:29
S67	4	"2003229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S68	2	"20030229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S69	45	"5,338,458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S70	45	"5338458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S71	213	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:02
S72	64	("1786483" | "1984164" | "2317857" | "20010002387" | "20010003116" | "20020134242" | "20020150516" | "20030136509" | "20040003716" | "20040013589" | "20050019240" | "20060048646" | "20060191835" | "20090062119" | "20100047146" | "20120183458" | "20140056787" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "4196173" | "4500327" | "4814152" | "4820318" | "4889698" | "4959162" | "5300137" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" |	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:20

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S73	3	("20090235848" | "20110076210" | "20150246315").PN.	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:31
S79	3	("20090235848" | "20110076210" | "20140224121").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:36
S80	96	("1984164" | "2317857" | "20010002387" | "20010003116" | "20020043496" | "20020134242" | "20020150516" | "20030104937" | "20030136509" | "20040003716" | "20040013589" | "20040076570" | "20050019240" | "20060048646" | "20060191835" | "20080182747" | "20080292512" | "20090062119" | "20090136401" | "20090320678" | "20100047146" | "20110168018" | "20120183458" | "20130280156" | "20140056787" | "20140255279" | "20140308188" | "20150098878" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "3876393" | "4094777" | "4101631" | "4196173" | "4338896" | "4500327" | "4708853" | "4786483" | "4814152" | "4820318" | "4889698" | "4956162" | "5300137" | "5336835" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" | "5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6638485" | "6808692" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "6960329" | "7081434" | "7211707" | "7435286" | "7479263" | "7514052" | "7521032" | "7544338" | "7563311" | "7611564" | "7622092" | "7722843" | "7767174" | "7780765" | "8007749" | "8168147" | "8168149" | "8216535" | "8512655" | "8652235" | "8821819" | "9011805").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:41
S81	593	honeycomb with plug$4 and plug$4 with length	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S82	0	honeycomb with plug$4 and plug$4 with length with less than with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S83	0	honeycomb with plug$4 and plug$4 with length with less than	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S84	127	honeycomb with plug$4 and plug$4 with length with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:46
S85	241	honeycomb with plug$4 and plug$4 with length with mm	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:47
S86	41	honeycomb with plug$4 and plug$4 with	US-PGPUB;	ADJ	ON	2017/06/27

		length with "3 mm "	USPAT			14:49
S87	28	honeycomb with plug$4 and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:52
S88	28	honeycomb and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:53
S89	43	honeycomb and plug$4 with porosity with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:06
S90	20	honeycomb and plug$4 with pore (size or diameter) with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:07
S91	8	saw with honeycomb with filter	US-PGPUB; USPAT	ADJ	ON	2017/06/29 13:31
S92	230	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/12/01 14:36
S93	2	"20060260468"	US-PGPUB; USPAT	ADJ	ON	2018/07/03 10:34
S94	19	engine with air with inlet with filter$4 with cone	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:26
S95	36	engine with air with inlet with filter$4 with (cone or conical or (diameter with (increas$4 or decreas$4)))	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:27
S96	24	("3771638" | "3870495" | "3872012" | "4157902" | "4702754" | "5125940" | "5522909" | "5549724" | "5632793").PN. OR ("5888260").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S97	41	("0153535" | "0439091" | "1398685" | "1530163" | "1887052" | "2087688" | "4003836" | "4018580" | "4032455" | "4039308" | "4065276" | "4261710" | "4410341" | "4414110" | "4699715" | "5106397" | "5178656" | "5522909" | "5549722" | "5549724" | "5888260" | "6397842" | "6508052" | "D401597" | "D401942" | "D403414" | "D403416").PN. OR ("6808552").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S98	15	("D403416").URPN.	USPAT	ADJ	ON	2018/07/03 15:33
S99	0	"20030089233"	USPAT	ADJ	ON	2018/07/04 12:29
S100	3	"20030089233"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S101	26	"6833023"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S102	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:08
S103	14	carbocations with sorbent with bromine	US-PGPUB; USPAT;	ADJ	ON	2018/07/09 13:14

			USOCR; FPRS; EPO; JPO			
S104	0	a side forming a cross sectional shape of each of the first	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:47
S105	0	non of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S106	0	none of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S107	0	none of sides forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S109	13	olson.in. and (alkali and promoter and earth).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S110	0	olson.in. and (alkali and promoter and earth with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S111	10	olson.in. and (alkali and promoter with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S112	0	"2015008283"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S113	2	"20150082833"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S114	24	olson.in. and liquid.clm. and promoted	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:50
S115	75	remov$4 with mercury and (br or bromine) with liquid with carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:54
S116	0	separating greater than "70" wt% of the mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S117	0	((separating greater) with (of the mercury)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S118	20	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:43

S119	40	(during with after with mercury with sorbent)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:38
S120	304	sorbent with mercury and sorbent with boiler	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:39
S121	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:41
S122	18	before with burn$4 with coal with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:42
S123	204	("0174348" | "0202092" | "0208011" | "0224649" | "0229159" | "0298727" | "0346765" | "0347078" | "0367014" | "0537926" | "0537998" | "0541025" | "0625754" | "0647622" | "0685719" | "0688782" | "0700888" | "0744908" | "0846338" | "0894110" | "0896876" | "0911960" | "0945331" | "0945846" | "1112547" | "1167471" | "1167472" | "1183445" | "1788466" | "1984164" | "20020065581" | "20020114749" | "20020184817" | "20030088370" | "20030103882" | "20040003716" | "20040013589" | "20040086439" | "20040219083" | "20050039598" | "20060047526" | "20060210463" | "2016821" | "2059388" | "2089599" | "2511288" | "3194629" | "3288576" | "3437476" | "3599610" | "3662523" | "3725530" | "3764496" | "3823676" | "3838190" | "3849267" | "3849537" | "3956458" | "3961020" | "3974254" | "4040802" | "4075282" | "4094777" | "4101631" | "4115518" | "4148613" | "4174373" | "4196173" | "4226601" | "4233274" | "4272250" | "4280817" | "4305726" | "4322218" | "4377599" | "4387653" | "4394354" | "4440100" | "4472278" | "4474896" | "4519807" | "4519995" | "4555392" | "4582936" | "4602918" | "4629721" | "4693731" | "4716137" | "4741278" | "4758418" | "4764219" | "4786483" | "4804521" | "4807542" | "4824441" | "4830829" | "4873930" | "4886519" | "4892567" | "4915818" | "4933158" | "4936047" | "4964889" | "5013358" | "5024171" | "5049163" | "5116793" | "5126300" | "5137854" | "5162598" | "5190566" | "5238488" | "5350728" | "5368617" | "5409522" | "5435980" | "5447703" | "5460643" | "5505746" | "5505766" | "5571490").PN. OR ("5587003" |	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/01 17:42

		"5618508" | "5635150" | "5659100" | "5670122" | "5733516" | "5738834" | "5787823" | "5810910" | "5897688" | "5910292" | "5989506" | "6024931" | "6083289" | "6240859" | "6258334" | "6372187" | "6375909" | "6475451" | "6521021" | "6528030" | "6533842" | "6558454" | "6610263" | "6613110" | "6719828" | "6732055" | "6737031" | "6746531" | "6790420" | "6808692" | "6848374" | "6878358" | "6942840" | "6953494" | "6962617" | "6974564" | "6975975" | "7468170" | "7507083" | "7674442" | "7758827" | "7776301").PN.				
S124	1	"15573128"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:07
S125	2	"20110207597"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:08
S126	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S127	71	sorbent with before with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S128	234	"6953494"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:38
S129	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:40
S130	35	promoter with sorbent and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S131	28	promoter with sorbent with mercury and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S132	4	promoter with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:20
S133	4	promot$4 with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:23

S134	4	promot$4 with sorbent with mercury and pre.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:41
S135	2	promot$4 with sorbent with mercury and pre-heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:42
S136	2	promot$4 with sorbent with mercury and pre heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S137	57	promot$4 with sorbent with mercury and pre	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S138	24	sorbent with preheat$4 with coal	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:39
S139	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:47
S140	23	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:28
S141	5	"14102896"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:48
S142	7	"12429058"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:09
S143	4	"12202595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:23
S144	20	"12201595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:24
S145	3	"14564860"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:27

S146	1	"15978760"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:28
S147	1	"15589359"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:32
S148	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:37
S149	8	"15997091"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S150	6	"14712558"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S151	2	"15951970"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:18
S152	4	"15382114"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:47
S153	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:51
S154	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:18
S155	69	"4279873"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:42
S156	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 07:59
S157	4	"15295594"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 08:08

S158	1	("20180257030").PN.	US-PGPUB; USPAT	ADJ	ON	2018/10/04 09:31
S159	86	"5569436"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:32
S160	6	"5785935"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S161	8	"6475471"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S162	53	"6103205"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:46
S163	0	pyrolysis with char with mercury with activated	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S164	17	pyrolysis with char with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S165	121	pyrolysis with char with activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S166	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S167	43	pyrolysis with char with activated carbon and mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S168	118	pyrolysis with char with tire	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S169	58	pyrolysis with char with activated carbon and mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S170	8	"20040081724"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2018/10/04 15:07

			FPRS; EPO; JPO			
S171	4	"14128179"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 15:10
S172	84	activat$4 carbon with boiler with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S173	88	activat$4 carbon with boiler with coal and (remov$4 or filter$4 or absorb$4 or adsorb$4) with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S174	0	mercury with stabiliz$4 with sulfer dioxide	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 14:23
S175	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 15:07
S176	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:48
S177	17	"8821819"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:51
S178	15	"8652235"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:55
S179	93	"6136749"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/24 09:08
S180	4	"9757689"	US-PGPUB; USPAT	ADJ	ON	2018/10/24 12:37
S181	9	"8939388"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 09:59
S182	669	urea with inject$4 with filter$4 with exhaust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:15

S183	2	urea with inject$4 with filter$4 with exhaust and urea with quench$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:16
S184	13	"3615165"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:35
S185	136	urea with quench$4 with remov$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:39
S186	48	urea dust with scrub$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 11:25
S187	38	"6221155"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 12:04
S188	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 14:12
S189	773	ammonium with remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:14
S190	108	ammonium with salt with remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:15
S191	45	ammonium with salt with remov$4 with mercury and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:15
S192	42	"5556447"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:21
S193	174	"4500327"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:21
S194	72	"4500327" and ammonium	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:23

S195	3	anionic couterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S196	3480	anionic counterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S197	2422	anionic counterion and ammonium with salt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S198	9	anionic counterion and ammonium with salt and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S199	52	"6960329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:50
S200	4	"20040003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/06 11:23
S201	1	"45219176".FMID.	US-PGPUB; USPAT; FPRS	ADJ	ON	2018/12/06 13:32
S202	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/01/07 09:41

1/7/2019 2:51:27 PM
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/974,343	Filing Date 05/08/2018	☐ To be Mailed

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), (l), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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	12/03/2018	(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))	* 17	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	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 $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/ALA H HUNTER/
*** 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.	

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/974,343 Group Art Unit: 1776
Filed: May 8, 2018 Docket No.: 4820.001US9
Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.111

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

Applicant has received the Non-Final Office Action dated October 29, 2018. Please enter the following.

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A method for separating mercury from a mercury-containing gas, the method comprising:

combusting a mixture of coal and an additive that has been added to the coal, the additive comprising a bromide compound, to form the mercury-containing gas, wherein the combusting of the mixture is performed at a coal combustion facility site;

adding a particulate sorbent material comprising activated carbon into the mercury-containing gas;

promoting at least a portion of the particulate sorbent material by ~~chemically~~ reacting the sorbent material with a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof, in-flight in a gas stream at the coal combustion facility site comprising contacting the particulate sorbent material dispersed in the gas stream with the promoter, to form a promoted sorbent material;

~~chemically reacting~~ capturing mercury in the mercury-containing gas with the promoted sorbent material, to form a mercury-sorbent; and

separating the mercury-sorbent from the mercury-containing gas.

2. (Original) The method of claim 1, further comprising mixing the additive and the coal before combusting the coal.

3. (Original) The method of claim 2, wherein the additive mixed with the coal is in a liquid.

4. (Original) The method of claim 3, wherein the liquid is a hydrocarbon, a chlorinated hydrocarbon, supercritical carbon dioxide, water, salt solution, or a combination thereof.

5. (Original) The method of claim 1, wherein the promoted sorbent material comprises active sites, wherein the active sites comprise halide anions bound to the activated carbon.

6. (Original) The method of claim 1, wherein the promoted sorbent material comprises active sites, wherein the active sites comprise carbocations bound to halide anions.

7. (Currently Amended) The method of claim 1, wherein ~~chemically~~ reacting the particulate sorbent material with the ~~additive~~promoter in the ~~mercury-containing gas~~gas stream comprises ~~chemically~~ reacting carbene species edge sites in the activated carbon with the ~~additive~~promoter.

8. (Original) The method of claim 1, wherein carbocations in the activated carbon of the mercury-sorbent accept electrons from mercury atoms of the mercury-sorbent.

9. (Original) The method of claim 1, wherein the additive is substantially in vapor form in the mercury-containing gas.

10. (Previously Presented) The method of claim 1, wherein the additive comprises Ca, Na, or a combination thereof.

11.-13. (Canceled)

14. (Original) The method of claim 1, wherein the activated carbon is chosen from powdered activated carbon, granular activated carbon, carbon black, carbon fiber, aerogel carbon, pyrolysis char, and combinations thereof.

15.-20. (Canceled)

21. (Previously Presented) The method of claim 1, wherein the coal and the additive are mixed at a location upstream of a combustion furnace where combustion occurs.

22. (Previously Presented) The method of claim 1, comprising separating greater than 70 wt% of the mercury from the mercury-containing gas.

23. (Currently Amended) The method of claim 1, comprising separating greater than 70 wt% of the mercury from the mercury-containing gas on the promoted sorbent material.

24. (Currently Amended) The method of claim 1, wherein the promoted sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon.

25. (Currently Amended) The method of claim 1, wherein the method is a method for reducing mercury in the mercury-containing gas to a desired level, wherein separating the mercury-sorbent from the mercury-containing gas forms a cleaned gas, the method further comprising:

monitoring the mercury content of the cleaned gas; and

controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of ~~injecting~~ the particulate sorbent material~~into the mercury-containing gas~~, a rate at which the promoter is added to the particulate sorbent ~~composition~~material, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below the desired level.

26. (New) The method of claim 1, wherein the additive comprises Br_2, HBr, Br^-, or a combination thereof.

REMARKS

This responds to the Non-Final Office Action dated October 29, 2018.

Claims 1, 7, and 23-25 are presently amended. No claims are presently canceled, and claims 11-13 and 15-20 were canceled previously. New claim 26 is are presently added. As a result, claims 1-10, 14, and 21-26 are now pending in this application.

Independent claim 1 is presently amended to recite "…a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof…."

Independent claim 1 is presently amended to recite "…promoting … in-flight in a gas stream at the coal combustion facility site comprising contacting the particulate sorbent material dispersed in the gas stream with the promoter…." Support can be found in the present published application at paragraphs [0076]-[0086].

Claim 25 is presently amended to recite "…controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of ~~injecting~~ the particulate sorbent material~~into the mercury-containing gas~~, a rate at which the promoter is added to the particulate sorbent ~~composition~~material, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below the desired level." Support can be found in the present published application at paragraph [0025].

No new matter is added via the amendments herein.

New claim 26 is added, reciting "…wherein the additive comprises Br_2, HBr, Br^-, or a combination thereof." Support can be found in the present published application at paragraphs [0042] (promoter can be bromide, Br^-), [0054] and [0072] (bromine, bromide, or HBr can be promoter), paragraphs [0077]-[0086] ("additive" can mean promoter), and FIG. 11 (the additive can be added to the coal). Claim 26 is dependent on independent claim 1 and, as such, incorporates all the features of claim 1. Accordingly, new dependent claim 26 is patentable for at least the reasons given herein for patentability of independent claim 1.

No new matter is added via the new claims herein.

The Rejection of Claims Under §112

I. The Office Action rejected claims 1, 7, and 23-25 under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as allegedly being indefinite.

This rejection is respectfully traversed.

The Office Action states that claim 1 recites the "the sorbent material" in line 3, which is lacking sufficient antecedent basis.

Claim 1 is presently amended to recite "…the particulate sorbent material…."

The Office Action states that claim 7 recites "the sorbent material" in line 1, which is lacking sufficient antecedent basis.

Claim 7 is presently amended to recite "…wherein ~~chemically~~ reacting the particulate sorbent material with the ~~additive~~promoter in the ~~mercury-containing gas~~gas stream comprises ~~chemically~~ reacting carbene species edge sites in the activated carbon with the ~~additive~~promoter."

The Office Action states that claim 23 recites "the sorbent" in line 2, which is lacking sufficient antecedent basis.

Claim 23 is presently amended to recite "…comprising separating greater than 70 wt% of the mercury from the mercury-containing gas on the promoted sorbent material."

The Office Action states that claim 24 recites "the sorbent material" in line 1, which is lacking sufficient antecedent basis.

Claim 24 is presently amended to recite "…wherein the promoted sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon."

The Office Action states that claim 25 recites "the sorbent" in line 6, which is lacking sufficient antecedent basis.

Claim 25 is presently amended to recite "…an injection rate of ~~injecting~~ the particulate sorbent material~~into the mercury-containing gas~~…."

The Office action states that claim 25 recites "the sorbent composition" in line 6, which is lacking sufficient antecedent basis.

Claim 25 is presently amended to recite "…a rate at which the promoter is added to the particulate sorbent ~~composition~~material…."

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 1, 7, and 23-25 under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph.

The Rejection of Claims Under §103

II. The Office Action rejected claims 1-3, 5-8, 14, and 21-25 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed.

Independent claim 1 is presently amended to recite "…combusting a mixture of coal and an additive that has been added to the coal, the additive comprising a bromide compound, to form the mercury-containing gas, wherein the combusting of the mixture is performed at a coal combustion facility site; adding a particulate sorbent material comprising activated carbon into the mercury-containing gas; promoting at least a portion of the particulate sorbent material by ~~chemically~~ reacting the sorbent material with a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof, in-flight in a gas stream at the coal combustion facility site comprising contacting the particulate sorbent material dispersed in the gas stream with the promoter, to form a promoted sorbent material; ~~chemically reacting~~ capturing mercury in the mercury-containing gas with the promoted sorbent material, to form a mercury-sorbent…."

As amended, any process encompassed by independent claim 1 includes in-flight promotion of activated carbon in the flue gas. Whether the activated carbon is untreated at the time of addition to the mercury-containing gas or the activated carbon is treated with an additive or promoter prior to addition to the mercury containing gas, the injected activated carbon encounters promoters in the flue gas formed from the combustion of the coal comprising the additive including a bromide compound, and is thereby promoted in-flight in the flue gas.

As explained herein at **II(A)**, there would be no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process. As explained herein at **II(B)(1)**, in-flight promotion with bromide promoters is more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas, and as explained herein at **II(B)(2)**, there would be no way for a person of ordinary skill in the art to predict this advantage from the cited references. As explained herein at **II(C)(1)**, in-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride-promoters, and as explained herein at **II(C)(2)**, there would be no way for a person of ordinary skill in the art to predict this advantage from the cited references. As explained herein at **II(D)**, even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties. As explained herein at **II(E)(1)**, activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas containing bromide promoters for in-flight promotion results in greater mercury removal than using activated carbon only treated with bromide additives outside the flue gas or activated carbon only treated with bromide promoters in-flight in the flue gas, and as explained herein at **II(E)(2)**, there would be no way for a person of ordinary skill in the art to predict this advantage from the cited references.

II(A). There would be no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process.

Independent claim 1 is presently amended to recite "…a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof…."

The Office Action admits that Felsvang fails to describe or suggest a halogen or halide promoter that is Br_2, HBr, or Br^-. Nelson fails to describe or suggest in-flight promotion of activated carbon with a halide in the flue gas. The Office Action alleges that one of ordinary skill in the art would combine Nelson's additive with Felsvang's method to accomplish the presently claimed method, stating that such a modification of Felsvang would be made "…to promote activated carbon (Nelson paragraphs [0017] and [0041]) so as to provide an effective carbon sorbent for mercury." (Office Action, page 4, last sentence of last full paragraph). Applicant respectfully

disagrees. As explained below, a person of ordinary skill in the art would not be motivated to use Nelson's bromide additives in Felsvang's process.

Felsvang is directed to adding chlorine (Cl_2) or chloride (Cl^-) materials to the coal or combustion products. Felsvang makes clear that addition of chlorine or chloride material increases the amount of chloride supplied to the flue gas, or to the drying-absorption zone, see, Abstract and col. 3, lines 40-44. When Felsvang mentions activated carbon, the interaction between activated carbon and chloride is the focus: "[i]t has been experienced that the increase of the Hg-removing effect of chloride addition to the drying-absorption zone in a process treating flue gases of low chloride content is especially remarkable when activated carbon is present…." Col. 3, line 67 bridging to col. 4, line 4. For a person of ordinary skill in the art to be motivated to replace Felsvang's chloride-treatment with treatment by another material to provide an effective carbon sorbent for mercury, that person would need to think that the material they are using to replace the chloride would result in the same or better mercury-removal efficiency. However, not only does Felsvang fail to describe or suggest that in-flight promotion of activated carbon with chloride provides better mercury removal than treatment of activated carbon outside the flue gas with chloride; further, as shown herein at **II(D)**, treatment of activated carbon outside the flue gas with chloride actually provides better mercury removal than in-flight promotion of activated carbon with chloride, which would lead one of ordinary skill in the art away from using in-flight promotion.

Nelson's Background paragraph [0017] states that "[t]he particular advantages of using bromine rather than iodine or iodides, or chlorine or chlorides, with activated carbons for mercury control have not been previously appreciated." The paragraph then goes on to describe various accomplishments in the prior art, stating that prior art processes fail to use bromine as a sequestration agent on carbon, and concludes with "[r]ather, it serves as a catalyst, taking part in a repeated series of desired chemical reactions, but not becoming permanently consumed by any of them. Perhaps it is understandable that the tenacity of carbon-bromine-mercury complexes could be overlooked." Importantly, paragraph [0017] states that bromine (Br_2) is superior to I_2 or I^-, or Cl_2 or Cl^-, with activated carbons for sequestration, and never states that the claimed promoters HBr or Br^- are more effective with activated carbons than chlorides.

Nelson's paragraph [0041] states:

> **[0041]** I have discovered that the simple act of exposing a carbonaceous material, preferably powdered activated carbon (PAC), to gaseous bromine, $Br_2(g)$, or to gaseous hydrogen bromide, HBr(g), significantly increases the carbonaceous material's ability to remove mercury species when injected into high-temperature coal-fired flue-gas compositions. Surprisingly, gaseous bromine produces a much more effective and appropriate carbon sorbent for mercury in hot combustion gases than do iodine or iodide species, or chlorine or chloride species, in contrast to what has been taught in the prior art.

Paragraph [0041] begins by stating that bromine, defined as Br_2, or hydrogen bromide, defined as HBr, increases the mercury absorption capacity of activated carbon. Then, paragraph [0041] states specifically that bromine (Br_2) produces a more effective mercury-absorbing carbon sorbent than iodine (I_2), or iodide (I^-), or chlorine (Cl_2), or chloride (Cl^-). With the precise definitions given for bromine and hydrogen bromide, and then reference only to bromine, Nelson makes clear that the comparison of efficacy is only with respect to bromine and not hydrogen bromide. Like paragraph [0017], paragraph [0041] also fails to state that HBr or Br^- are more effective with activated carbons than chlorides.

The majority of Nelson's Examples (1-4 and 8) focus only on Br_2. Nelson's Examples 5-7 demonstrate the use of HBr-treated sorbent; however, none of these Examples or any other parts of Nelson compare the mercury-absorption performance of HBr-treated activated carbon to chloride-treated activated carbon such as HCl-treated activated carbon. Although figures 14 and 15 illustrate HBr-treated activated carbon and Cl_2-treated activated carbon, Cl_2-treated activated carbon is not chloride-treated carbon and these figures fail to show any examples of chloride-treated activated carbon.

Nelson's paragraph [0049] states:

> **[0049]** A critical element in the process is that a bromine-containing gas **3** is used to treat the carbonaceous substrate. Preferably this gas comprises elemental bromine, $Br_2(g)$, although other bromine-containing gases, such as hydrogen bromide, HBr, will also have the advantageous effect of the invention.

Paragraph [0049] says that using Br_2 is a critical element of the process. It states that HBr can also have the "advantageous effect of the invention"; however, it is not clear what advantage this is

referring to. The very next paragraph, [0050], states "[i]n the liquid form at ambient temperatures, elemental bromine is dense and compact, with advantages in transport and storage." These statements also hold true for HBr in the form of a gas. No Example is given in Nelson comparing the mercury-absorption performance of activated carbons treated with bromides such as HBr to the mercury-absorption performance of chlorides such as HCl. In every statement comparing to other halogens or halides, Nelson states with great particularity, even giving the chemical formula, that bromine (Br_2) has advantageous effects over other halogens and halides but fails to mention bromides in these statements. One of ordinary skill in the art would not interpret paragraph [0049] or any other part of Nelson as describing or suggesting that bromides even have the same effectiveness for mercury sequestration when used to treat activated carbons as chlorides, let alone that bromides are more effective for mercury sequestration when used to treat activated carbons than chlorides or chlorine.

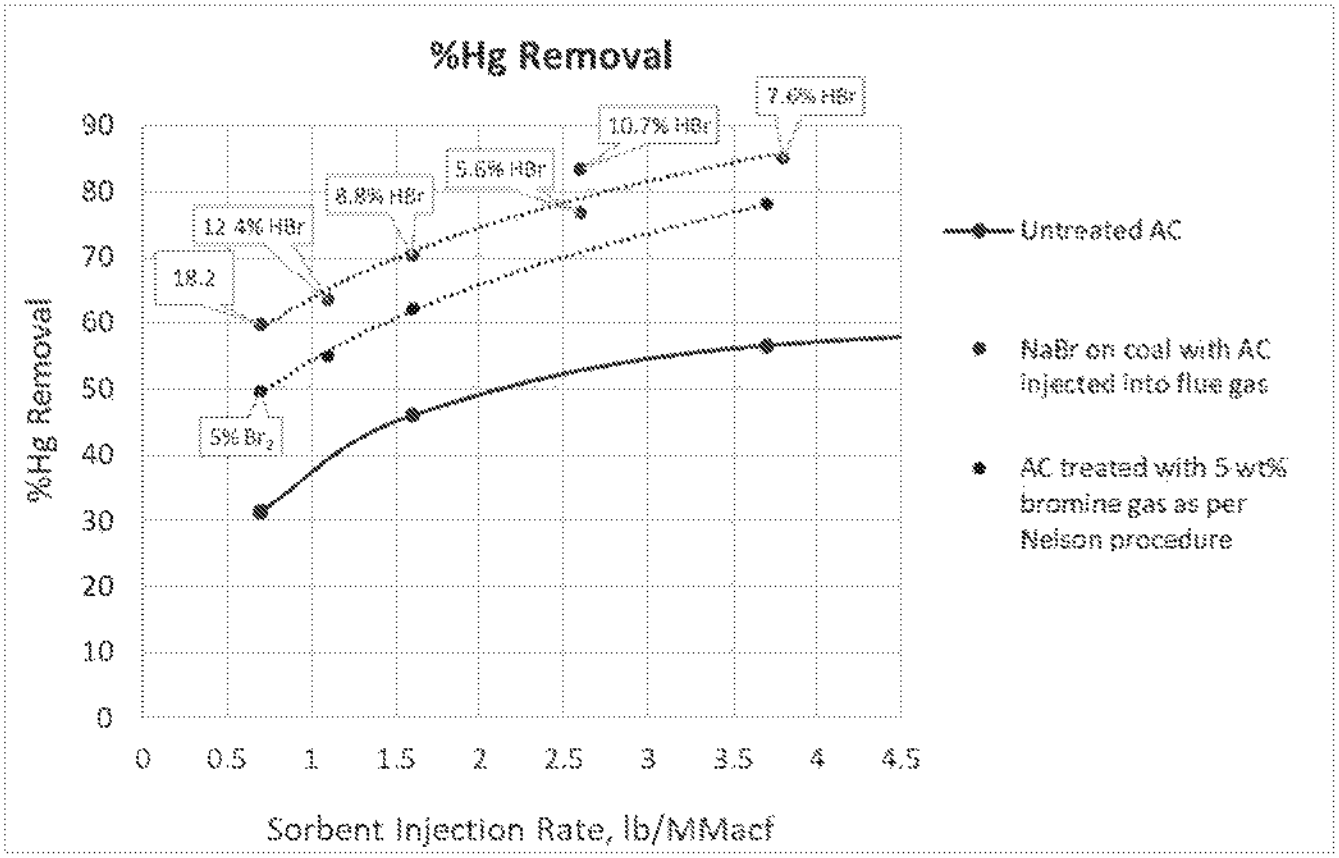
Nelson fails to describe or suggest that treatment of activated carbon with bromides such as HBr could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to activated carbons treated with chlorides. Not only does Felsvang fail to describe or suggest that in-flight promotion of activated carbon with chloride provides better mercury removal than treatment of activated carbon outside the flue gas with chloride; further, as shown herein at **II(D)**, treatment of activated carbon outside the flue gas with chloride actually provides better mercury removal than in-flight promotion of activated carbon with chloride, which would lead one of ordinary skill in the art away from using in-flight promotion. A person of ordinary skill in the art would have no reason to modify Felsvang's chloride process with a different promoter to form an effective carbon sorbent for mercury if the resulting mercury-removal efficiency could not be reasonably predicted to be the same or greater as that of Felsvang's original process. Therefore, a person of ordinary skill in the art would not be motivated to combine Nelson's bromide additive with Felsvang's chloride method. Independent claim 1 is patentable for at least this reason.

II(B)(1). In-flight promotion with bromide promoters is more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas.

The inventors of the present application have discovered that by combusting coal in the presence of a bromide promoter, and by placing an activated carbon sorbent in the mercury-

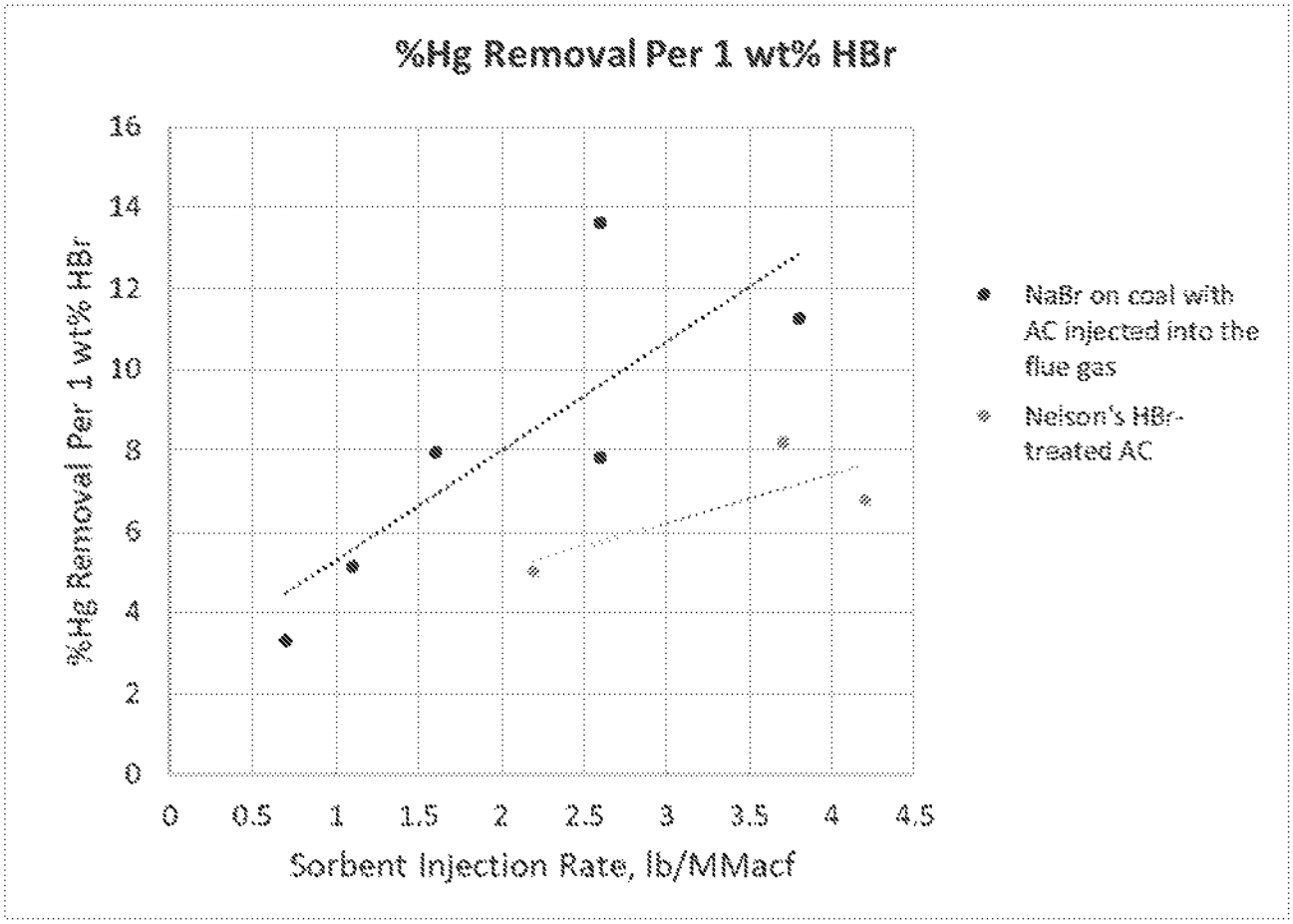
containing gas, as presently claimed, the activated carbon can be promoted by the promoter in-flight in the mercury-containing gas, and further, that in-flight bromide promotion of the activated carbon is more effective for mercury removal than use of an activated carbon that is treated with bromides or bromine outside the flue gas.

As explained in the 37 CFR § 1.132 declaration by John Pavlish filed with the Non-Final Office Action Response for Application No. 15/978,760 on December 3, 2018 ("first 132 Declaration"), pilot-scale testing was performed with activated carbon alone (untreated) injected into the flue gas, the activated carbon treated with Br_2 outside the flue gas as per the Nelson procedure (see, first 132 Declaration at item 6), and with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The same activated carbon was used for each sample. See, the first 132 Declaration at items 8-11. The plot given in the first 132 Declaration at item 11 is reproduced below.



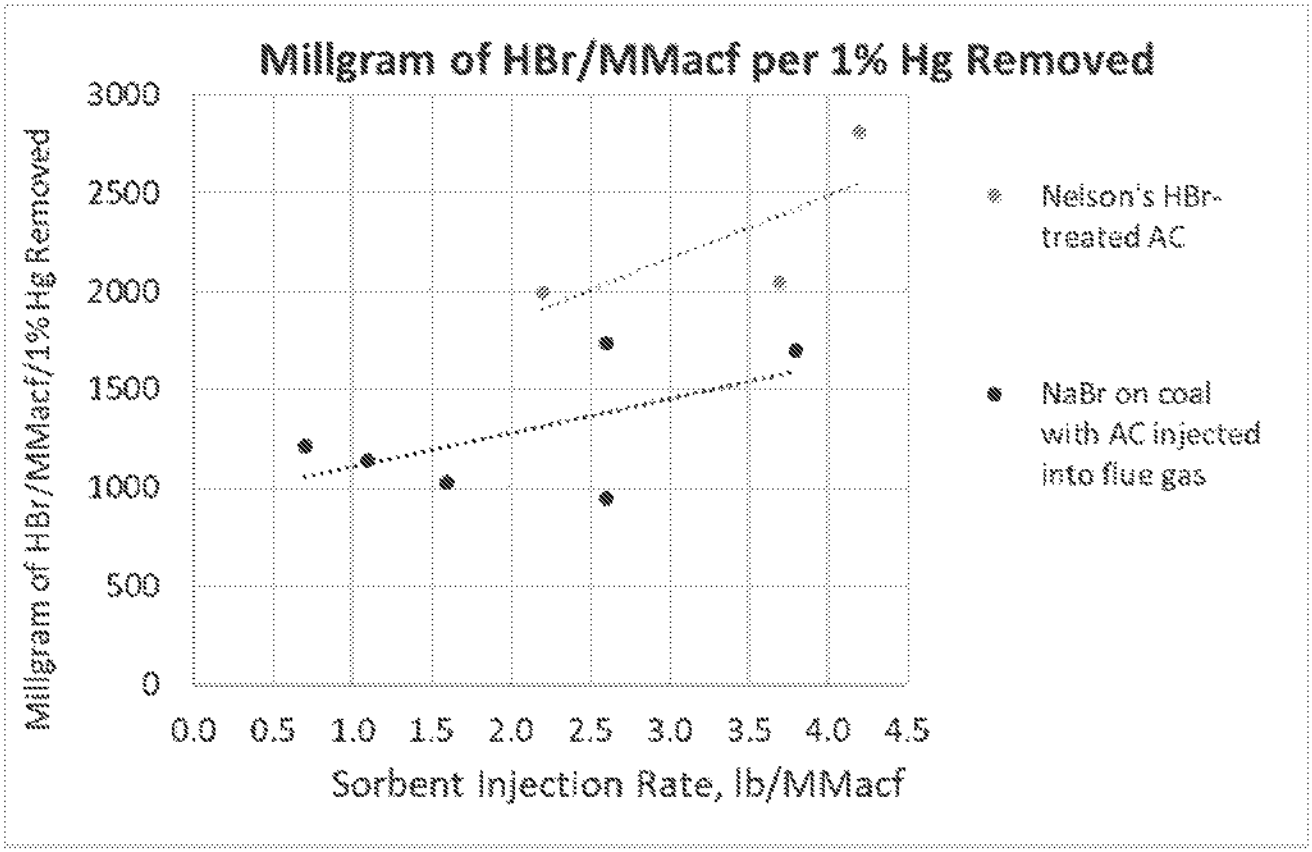
The data in the plot above from item 11 of the first 132 Declaration show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas (in-flight promotion with Br^-) provided a higher percent of mercury removal at all tested sorbent injection rates as compared to the activated carbon alone (untreated) and compared to the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure. With NaBr added to the coal and activated carbon injected into the flue gas, there was a significant reduction in the amount of sorbent required to acheive similar mercury removal compared to the activated carbon treated with Br_2 outside the flue gas. For example, to acheive 70% mercury removal, 2.5 lb/MMacf of Br_2-treated carbon was required, as compared to 1.6 lb/MMacf with NaBr added to the coal and activated carbon injected into the flue gas; an additional (2.5-1.6/1.6)*100% or 56% treated sorbent was required to achieve the same leval of mercury removal. See, first 132 Declaration at items 2-5 and 12.

The percent mercury removal per 1 wt% HBr versus the sorbent injection rate was compared with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas using the pilot-scale plant, and with Nelson's activated carbon treated with HBr outside the flue gas. The data for Nelson's activated carbon treated with HBr outside the flue gas was taken directly from Nelson. The first plot given in the first 132 Declaration at item 13 is reproduced below, but only showing the bromide data.



The data in the plot above, derived from the first plot at item 13 of the first 132 Declaration, show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 2x) percent mercury removal per 1 wt% HBr at all tested sorbent injection rates as compared to Nelson's activated carbon treated with HBr outside the flue gas. See, first 132 Declaration at item 14.

The data from the pilot-scale plant was also plotted to show the milligrams of HBr/MMacf per 1% mercury removal versus the sorbent injection rate with NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for Nelson's activated carbon treated with HBr outside the flue gas. The second plot given in the first 132 Declaration at item 13 is reproduced below.



The data in the plot above, derived from the second plot at item 13 of the first 132 Declaration, show that NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly lower milligrams of HBr/MMacf per 1% mercury removal at all tested sorbent injection rates as compared to Nelson's activated carbon treated with HBr outside the flue gas, indicating more efficient (approximately 2x) use of HBr for mercury removal during in-flight promotion of activated carbon than treatment of activated carbon outside the flue gas. See, first 132 Declaration at item 14.

II(B)(2). There is no way a person of ordinary skill in the art could predict from the cited references that in-flight promotion of a sorbent with bromide promoters is more effective for mercury removal than use of a sorbent that is treated with the same promoters outside the flue gas.

The M.P.E.P. at the beginning of § 2143.02 states (emphasis added) "[a] rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in

the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, *and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art.*"

As admitted by the Office Action, Felsvang fails to describe or suggest bromide promoters. Felsvang also fails to describe or suggest that treatment of an activated carbon with a chloride additive outside of flue gas has any advantages over in-flight promotion of an activated carbon with a chloride promoter. Further, as shown herein at **II(D)**, treatment of activated carbon outside the flue gas with chloride provides better mercury removal than in-flight promotion of activated carbon with chloride. Therefore, a person of ordinary skill in the art hypothetically having Felsvang in-hand would have no clue that in-flight promotion of activated carbon with a halide could give the same or better percent mercury removal over halide treatment outside of the flue gas, and would be led away from Felsvang's in-flight process if they investigated the relative mercury removal of treatment of the activated carbon with chloride outside the flue gas versus in-flight treatment with chloride in the flue gas.

Nelson mentions treating activated carbon outside of flue gas, and then adding the activated carbon to flue gas. Nelson fails to describe or suggest in-flight promotion of an activated carbon with a halide in the flue gas. Therefore, a person of ordinary skill in the art hypothetically having Nelson in-hand would *also* have no idea that in-flight promotion of activated carbon with a halide could have any advantages over halide treatment outside of the flue gas.

There is no way to predict from the presently cited references the superior mercury capture discovered by the present inventors that occurs when activated carbon is promoted with bromide promoters in-flight in the mercury-containing gas, as occurs when following the present claims. The Office Action states at the end of the last full paragraph on page 4 that Nelson's additives would be combined with Felsvang's in-flight promotion "…so as to provide an effective carbon sorbent for mercury." However, a person of ordinary skill in the art would have no idea that in-flight promotion with bromide promoters could work better than Nelson's bromide-treatment outside the flue gas. Felsvang fails to describe or suggest that in-flight promotion provides a sorbent with even the same (let alone superior) properties as a sorbent treated outside the flue gas, and, as explained herein at **II(D)**, treatment of activated carbon outside the flue gas with chloride actually provides better mercury removal than in-flight promotion of activated carbon with chloride; similarly, Nelson fails

to describe in-flight promotion, let alone that in-flight promotion provides the same or superior mercury removal ability as compared to treatment outside the flue gas.

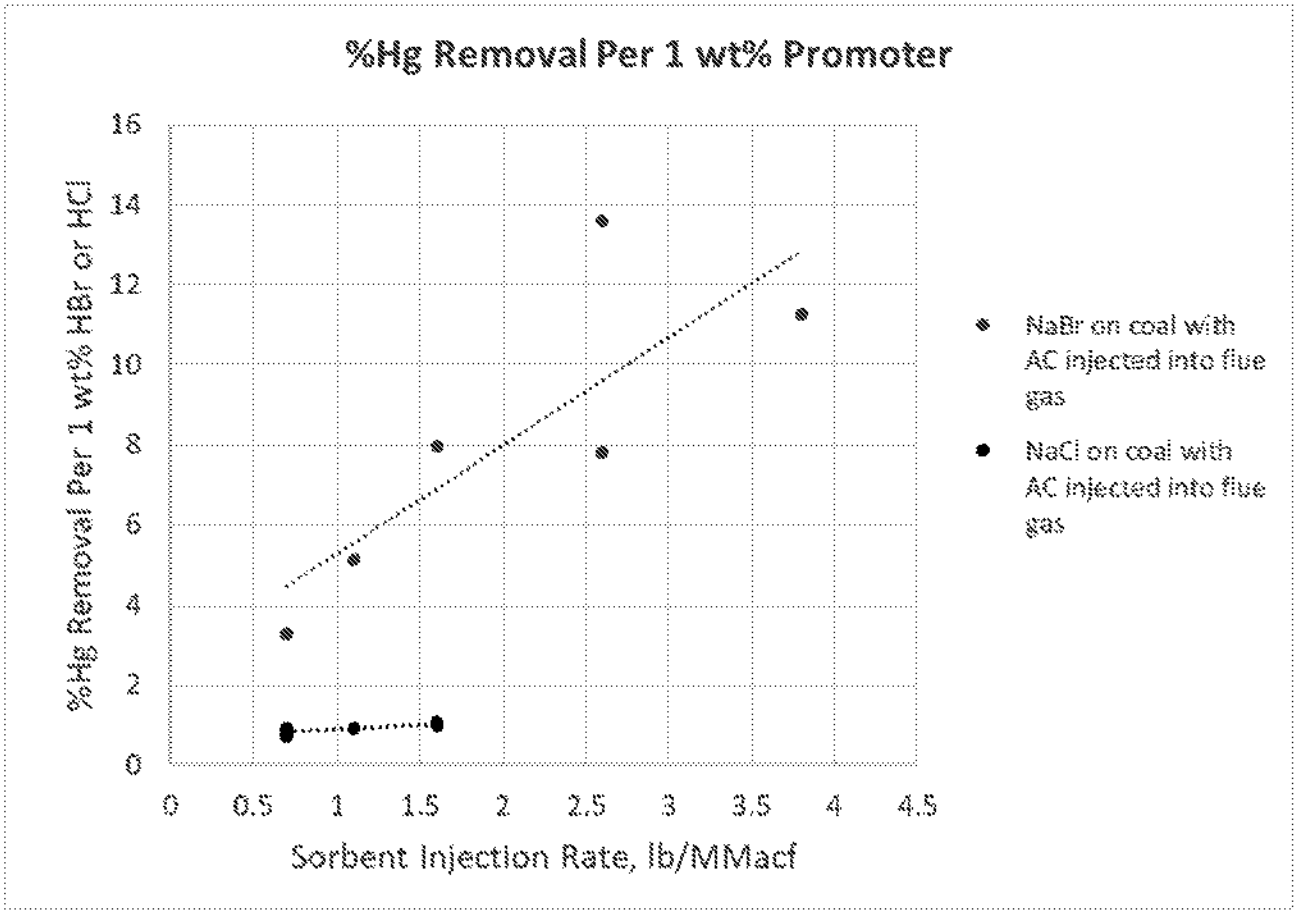
The only way that a person of ordinary skill in the art could discover that in-flight promotion of activated carbon with bromide promoters is more effective for mercury removal than bromide treatment outside the flue gas would not be from the cited references alone; instead, the person of ordinary skill would need to actually modify Felsvang with Nelson as alleged, and then to compare the mercury removal of Felsvang's modified process to Nelson's sorbent treated outside the flue gas.[1] However, the person of ordinary skill carrying out such a combination would be surprised to find that in-flight promotion with bromide is more effective for mercury removal than bromide treatment of the sorbent outside the flue gas. The process giving rise to these surprising results was discovered by the inventors of the present application. Surprising results are a hallmark of patentability; only by having the present application in-hand could such results be predicted, and a need to resort to hindsight analysis to predict the advantages of the combination asserted by the Office Action is indicative that the presently claimed invention is not obvious over the cited references. Accordingly, independent claim 1 is patentable over Felsvang in view of Nelson for at least this additional reason.

II(C)(1). In-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride-promoters.

The inventors of the present application have discovered that that in-flight bromide promotion of an activated carbon in a mercury-containing flue gas is significantly more effective for mercury removal than in-flight chloride promotion of an activated carbon.

As explained in the first 132 Declaration, pilot-scale testing was performed with NaBr or NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The same activated carbon was used for each sample. See, the first 132 Declaration at items 8-10. The first plot given in the first 132 Declaration at item 13 is reproduced below, but not showing the data from Nelson's HBr-treated AC.

[1] In the event the Examiner intends to argue that such advantages are inherent in the cited art, Applicant notes that the claimed invention is not specifically disclosed in the prior art. The Examiner cannot reason inherency in a §103 context based on a mere proposed or hypothetical combination of features from cited references. Such reasoning would merely reflect the Examiner's reliance on impermissible hindsight. See, M.P.E.P. § 2112(IV).



The data in the plot above, derived from the first plot at item 13 of the first 132 Declaration, show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 6-8x) percent mercruy removal per 1 wt% HBr or HCl at all tested sorbent injection rates compared to the NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. See, first 132 Declaration at item 14.

II(C)(2). There would be no way for a person of ordinary skill in the art to predict this advantage from the from the cited references.

As explained herein at **II(A)**, Nelson fails to describe or suggest that treatment of activated carbon with bromides such as HBr could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to Felsvang's activated carbons promoted with chlorides.

The only way that a person of ordinary skill in the art could discover that in-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride promoters would not be from the cited references alone; instead, the person of ordinary skill would need to actually modify Felsvang with Nelson as alleged, and then to compare the mercury removal of Felsvang's modified process to Felsvang's original process.[2] However, the person of ordinary skill carrying out such a combination would be surprised to find that promotion of activated carbon with bromides such as HBr could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to Felsvang's activated carbons promoted with chlorides. The process giving rise to these surprising results was discovered by the inventors of the present application. Surprising results are a hallmark of patentability; only by having the present application in-hand could such results be predicted, and a need to resort to hindsight analysis to predict the advantages of the combination asserted by the Office Action is indicative that the presently claimed invention is not obvious over the cited references. Accordingly, independent claim 1 is patentable over Felsvang in view of Nelson for at least this additional reason.

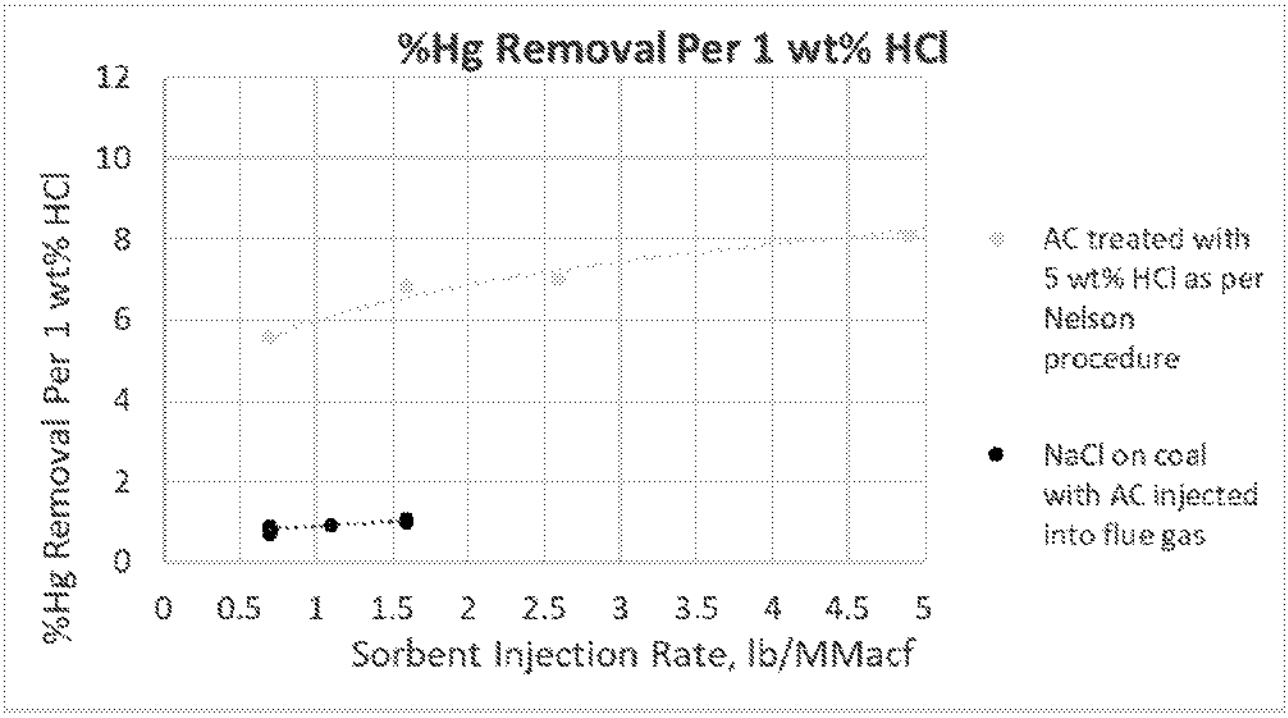
II(D). Even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury removal properties.

As explained herein at **II(A)**, Felsvang fails to describe or suggest that in-flight promotion of activated carbon with chloride provides better mercury removal than treatment of activated carbon outside of the flue gas. For the sake of argument, even if a person of ordinary skill in the art were to compare mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas, they would not find that in-flight promotion provides the same or better mercury-removal properties.

As explained in the first 132 Declaration, pilot-scale testing was performed with activated carbon treated with HCl outside the flue gas as per the Nelson procedure (see, first 132 Declaration

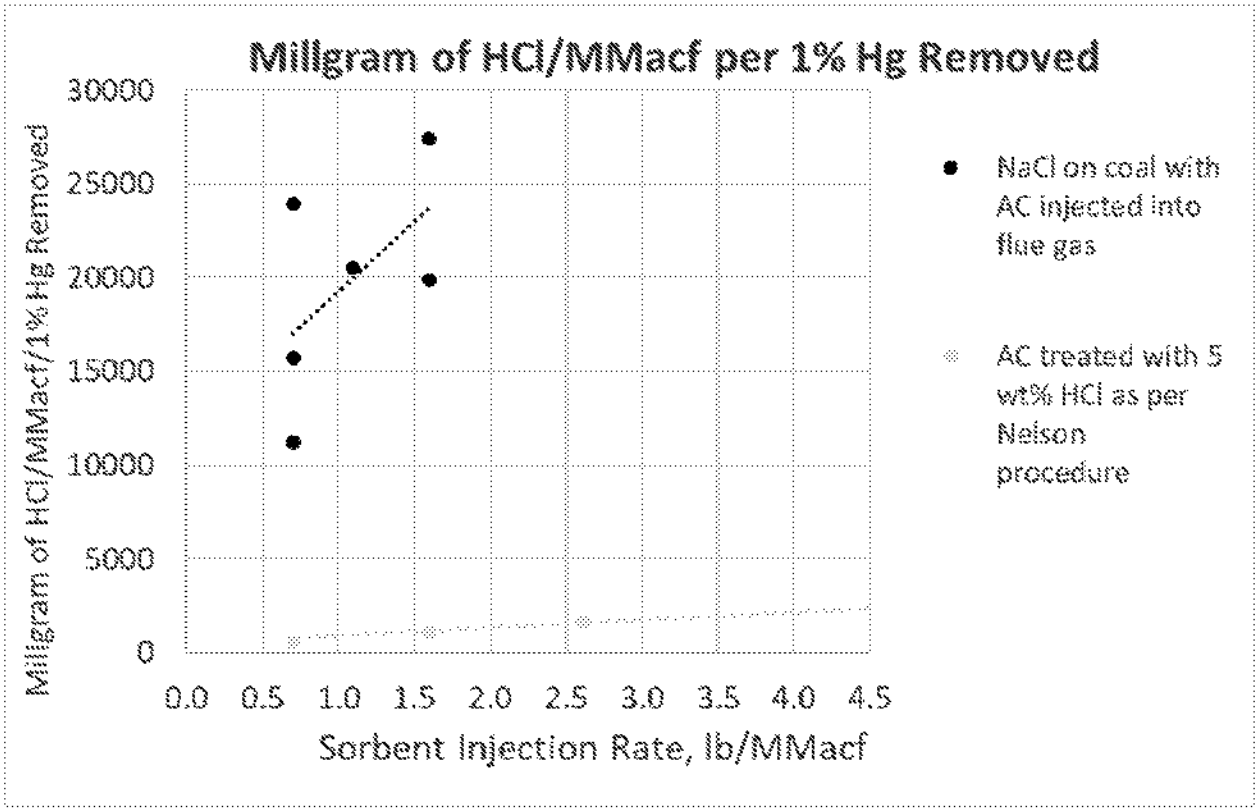
[2] In the event the Examiner intends to argue that such advantages are inherent in the cited art, Applicant notes that the claimed invention is not specifically disclosed in the prior art. The Examiner cannot reason inherency in a §103 context based on a mere proposed or hypothetical combination of features from cited references. Such reasoning would merely reflect the Examiner's reliance on impermissible hindsight. See, M.P.E.P. § 2112(IV).

at item 7), and with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. The same activated carbon was used for each sample. See, the first 132 Declaration at items 8-10. The first plot given in the first 132 Declaration at item 15 is reproduced below.



The data in the plot above from the item 15 of the first 132 Declaration show that activated carbon treated with HCl outside the flue gas as per the Nelson procedure provided a much higher percent of mercury removal per 1 wt% HCl at all tested sorbent injection rates as compared to NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas. See, first 132 Declaration at item 16.

The pilot-scale data was also plotted to show the milligrams of HCl/MMacf per 1% mercury removal versus the sorbent injection rate with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure. The second plot given in the first 132 Declaration at item 15 is reproduced below.



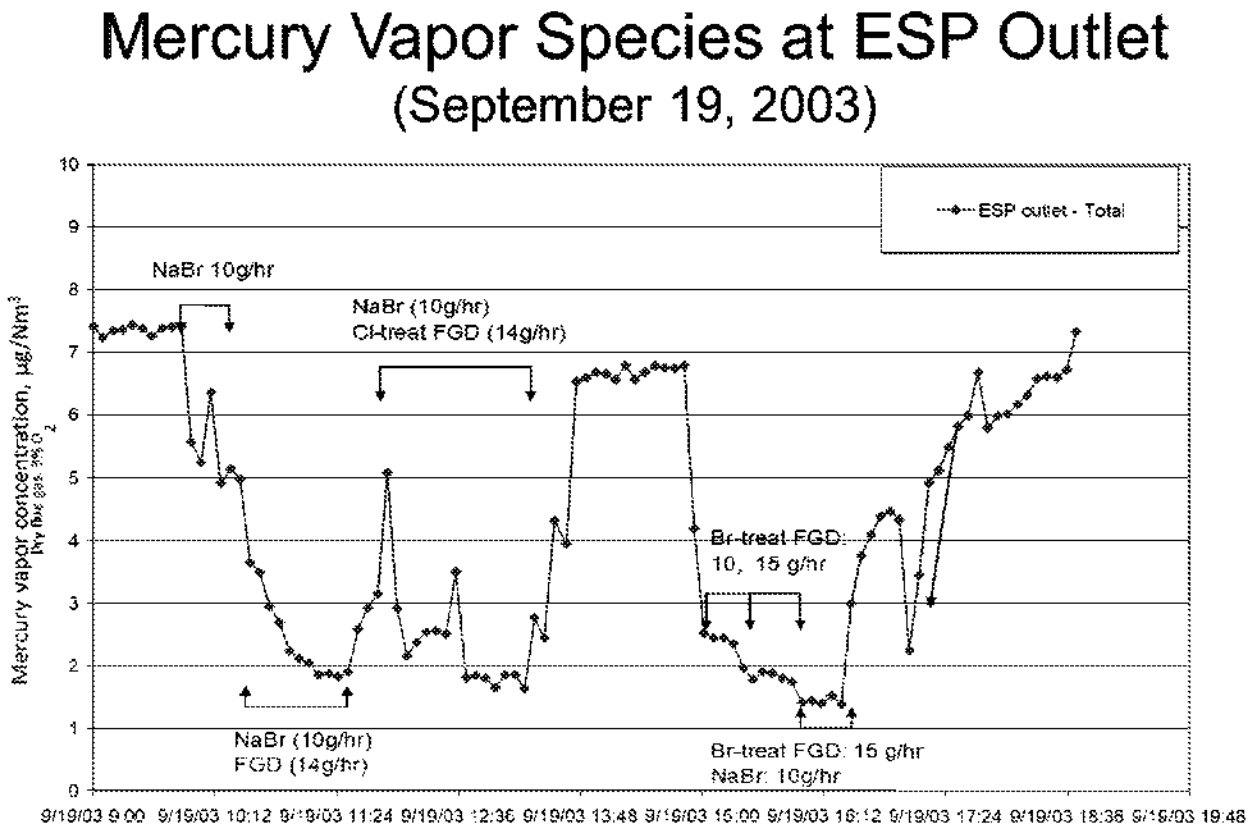
The data in the second plot above from item 15 of the Declaration show that the milligrams of HCl/MMacf per 1% mercury removal versus the sorbent injection rate with NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas was significantly higher as compared to the activated carbon treated with HCl outside the flue gas described herein at item 7 as per the Nelson procedure, indicating more efficient use of HCl for mercury removal by treatment of activated carbon outside the flue gas than by promotion in-flight.

II(E)(1). Activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas containing bromide promoters for in-flight promotion results in greater mercury removal than using activated carbon only treated with bromide additives outside the flue gas or activated carbon only treated with bromide promoters in-flight in the flue gas.

As explained in the 37 CFR § 1.132 declaration by John Pavlish filed herewith ("second 132 Declaration"), the following data show trends that provide evidence that using activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas

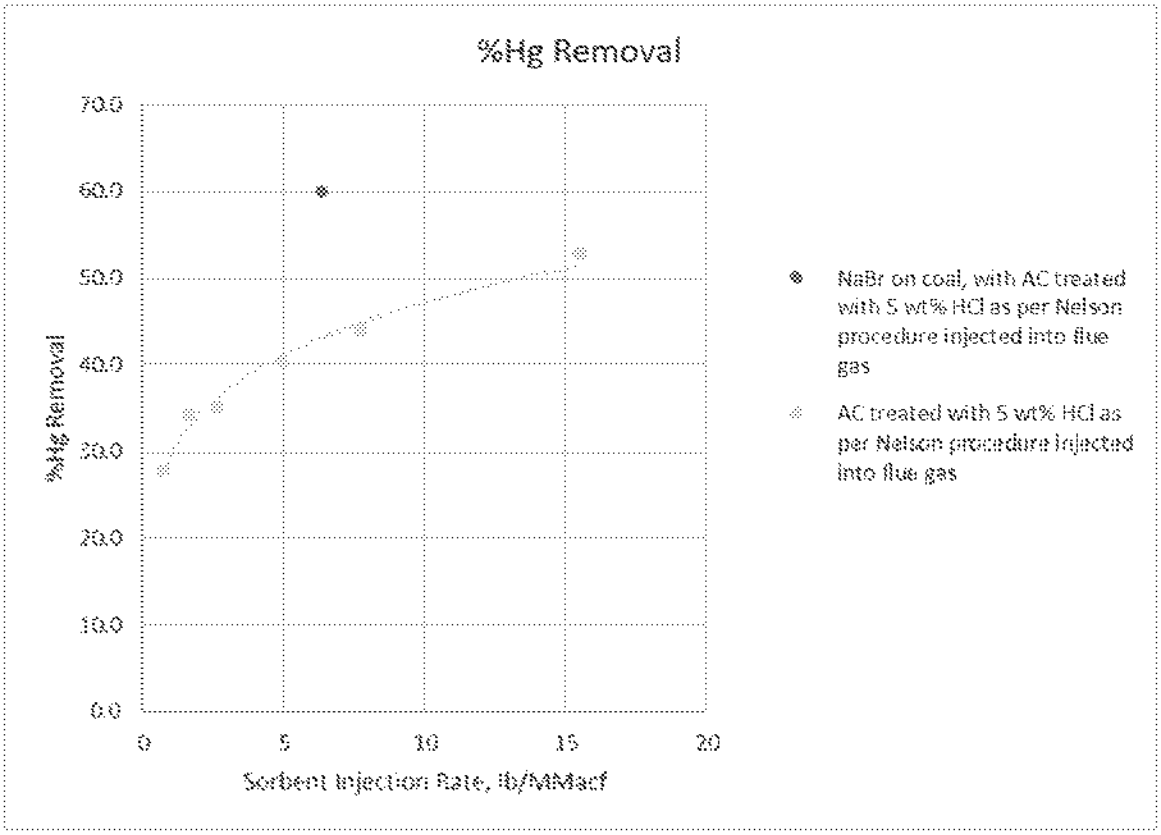
containing bromide promoters for in-flight promotion results in greater mercury removal than using activated carbon only treated with bromide additives outside the flue gas or activated carbon only treated with bromide promoters in-flight in the flue gas. Although the additives used to treat injected activated carbon in this section are HCl or Br_2, the trends shown would be expected to occur also with bromide-treated activated carbon. See, second 132 Declaration at item 18.

Pilot-scale testing was performed, using lignite coal and Norit DARCO® FGD, and the mercury content at the ESP outlet was measured with NaBr on coal, with NaBr on coal with injection of untreated activated carbon into the flue gas, with NaBr on coal with injection of 5 wt% HCl-treated activated carbon, with injection of 5 wt% Br_2-treated activated carbon without additives on the coal, and with NaBr on the coal with injection of 5 wt% Br_2-treated activated carbon. See, the second 132 Declaration at items 2-4. The plot given in the second 132 Declaration at item 5 is reproduced below.



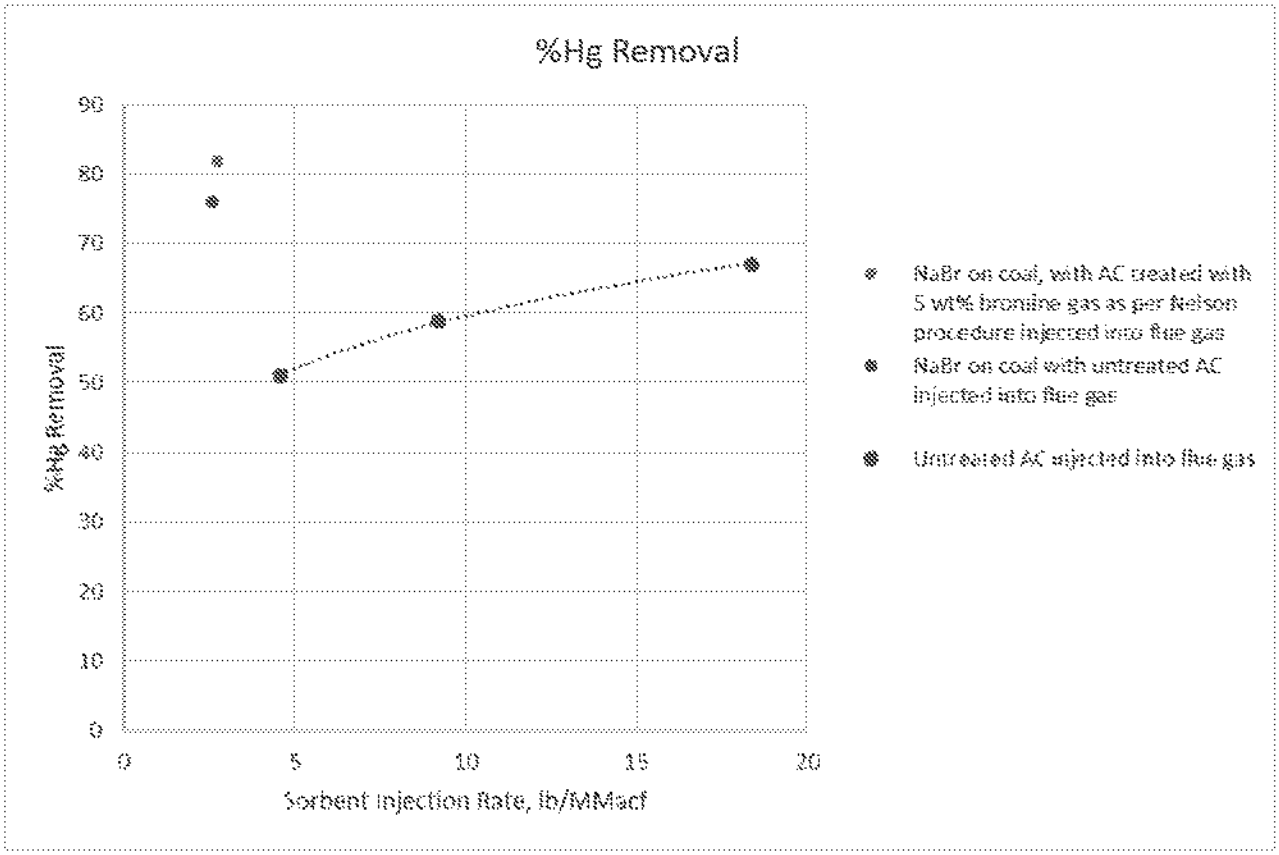
The data in the plot above from item 5 of the second 132 Declaration shows that, compared to placing NaBr on the coal and injecting untreated activated carbon into the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas provided greater mercury removal. The data in the plot above also shows that, compared to injecting activated carbon into the flue gas treated with 5 wt% Br_2 outside the flue gas, and compared to placing NaBr on the coal and injecting untreated activated carbon into the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% Br_2 outside the flue gas provided greater mercury removal. Therefore, in-flight promotion of activated carbon with bromide in the flue gas provides even greater mercury removal if the activated carbon has already been treated with Br_2 or HCl outside the flue gas prior to injection. In-flight bromide promotion in the flue gas of activated carbon treated with Br_2 outside the flue gas also provides greater mercury removal than injecting activated carbon treated with Br_2 outside the flue gas with no in-flight bromide promotion. See, second 132 Declaration at item 6.

The pilot-scale testing was repeated, using lignite coal and Norit DARCO® FGD, with NaBr on coal with injection of 5 wt% HCl-treated activated carbon, and with injection of 5 wt% HCl-treated activated carbon without NaBr on coal. See, second 132 Declaration at item 7. The plot given in the second 132 Declaration at item 8 is reproduced below.



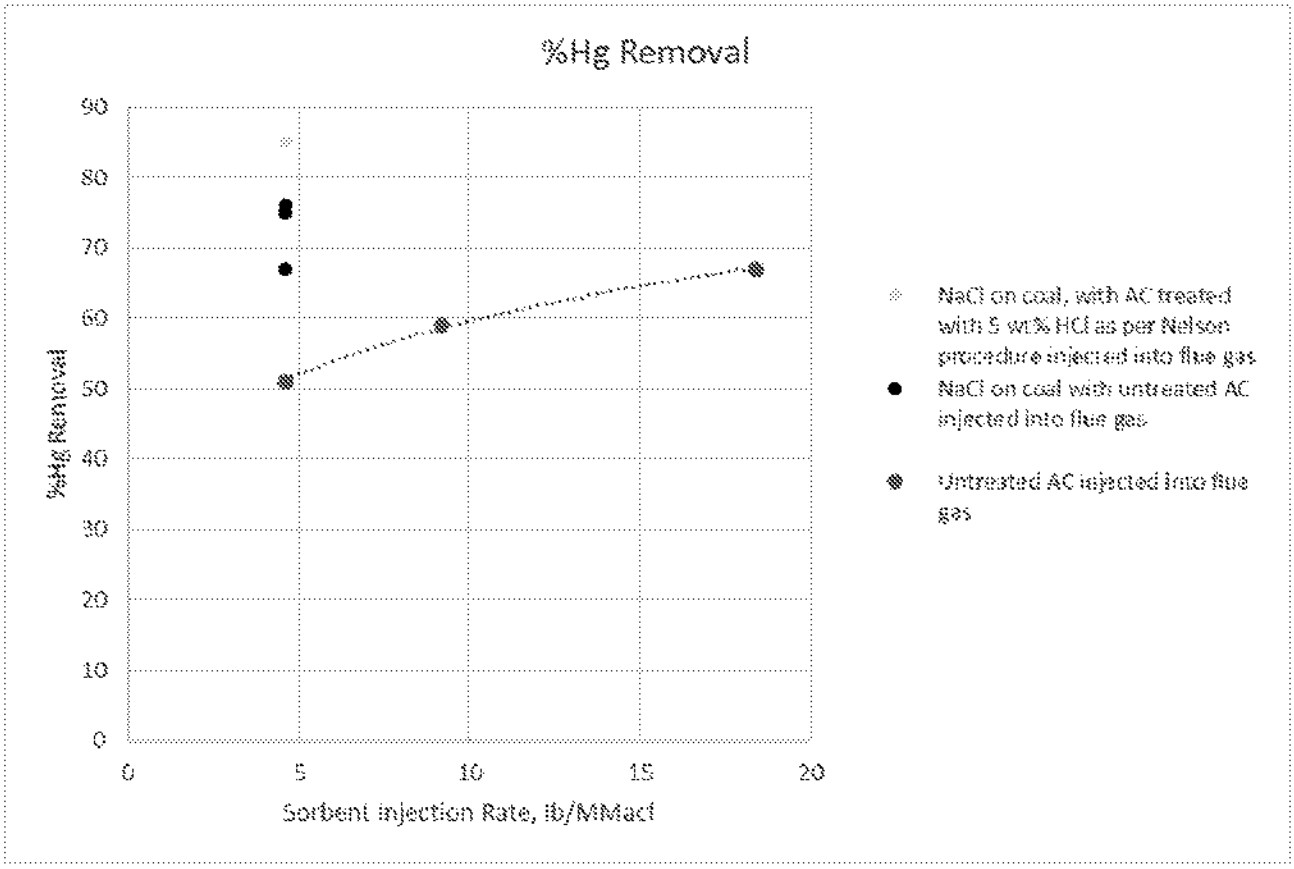
The data in the plot above from item 8 of the second 132 Declaration shows that, compared to injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas provided greater mercury removal. Therefore, in-flight bromide promotion in the flue gas of activated carbon treated with HCl outside the flue gas provides greater mercury removal than injecting activated carbon treated with HCl outside the flue gas with no in-flight bromide promotion. See, second 132 Declaration at item 9.

The pilot-scale testing was repeated, using subbituminous coal and Norit DARCO® Hg, with injection of untreated activated carbon into the flue gas, NaBr on coal with injection of untreated activated carbon into the flue gas, and with NaBr on coal with injection of 5 wt% Br_2-treated activated carbon into the flue gas. See, second 132 Declaration at items 10-12. The plot given in the second 132 Declaration at item 13 is reproduced below.



The data in the plot at item 13 shows that, compared to placing NaBr on the coal and injecting untreated activated carbon into the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% Br_2 outside the flue gas provided greater mercury removal. Therefore, in-flight promotion of activated carbon with bromide in the flue gas provides even greater mercury removal if the activated carbon has already been treated with Br_2 outside the flue gas prior to injection. See, second 132 Declaration at item 14.

The pilot-scale testing was repeated, using subbituminous coal and Norit DARCO® Hg, with injection of untreated activated carbon into the flue gas, NaCl on coal with injection of untreated activated carbon into the flue gas, and with NaCl on coal with injection of 5 wt% HCl-treated activated carbon into the flue gas. See, second 132 Declaration at item 15. The plot given in the second 132 Declaration at item 16 is given below.



The data in the plot above from item 16 of the second 132 Declaration shows that, compared to placing NaCl on the coal and injecting untreated activated carbon into the flue gas, placing NaCl on the coal and injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas provided greater mercury removal. Therefore, in-flight promotion of activated carbon with chloride in the flue gas provides even greater mercury removal if the activated carbon has already been treated with chloride outside the flue gas prior to injection. See, second 132 Declaration at item 17.

II(E)(2). There would be no way for a person of ordinary skill in the art to predict this advantage from the cited references.

Neither Felsvang nor Nelson describes or suggests that activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas containing bromide promoters for in-flight promotion results in greater mercury removal than using activated

carbon only treated with bromide additives outside the flue gas or activated carbon only treated with bromide promoters in-flight in the flue gas. The only way that a person of ordinary skill in the art could discover that that activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas containing bromide promoters for in-flight promotion results in greater mercury removal than using activated carbon only treated with bromide additives outside the flue gas or activated carbon only treated with bromide promoters in-flight in the flue gas would not be from the cited references alone; instead, the person of ordinary skill would need to actually modify Felsvang with Nelson as alleged, and would need to make a further modification of Felsvang that also includes injection of sorbents treated with bromide additives outside the flue gas.[3] As explained herein at **II(A)**, there would be no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process in the first place; therefore, one of ordinary skill in the art would not use bromide compounds on the coal of Felsvang's process, let alone combine bromide compounds on coal with injection of activated carbon treated with bromide additives outside the flue gas. Even if the person of ordinary skill hypothetically placed Nelson's additives on Felsvang's coal, they would be surprised to find that in-flight promotion with bromide is more effective for mercury removal than bromide treatment of the sorbent outside the flue gas, as explained herein at **II(B)**; similarly, such a person of ordinary skill in the art carrying out the further modification of using Nelson's activated carbon treated with bromide outside the flue gas for injection into the flue gas formed from combustion of coal including Nelson's bromide additives would also be surprised that the further modification results in even greater mercury removal. The process giving rise to these surprising results was discovered by the inventors of the present application. Surprising results are a hallmark of patentability; only by having the present application in-hand could such results be predicted, and a need to resort to hindsight analysis to predict the advantages of the combination asserted by the Office Action is indicative that the presently claimed invention is not obvious over the cited references. Accordingly, independent claim 1 is patentable over Felsvang in view of Nelson for at least this additional reason.

[3] In the event the Examiner intends to argue that such advantages are inherent in the cited art, Applicant notes that the claimed invention is not specifically disclosed in the prior art. The Examiner cannot reason inherency in a §103 context based on a mere proposed or hypothetical combination of features from cited references. Such reasoning would merely reflect the Examiner's reliance on impermissible hindsight. See, M.P.E.P. § 2112(IV).

Dependent claims 2-3, 5-8, 14, and 21-25 are dependent on independent claim 1. As such, these dependent claims incorporate all the features of claim 1. Accordingly, dependent claims 2-3, 5-8, 14, and 21-25 are patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 1-3, 5-8, 14, and 21-25 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson.

III. The Office Action rejected claim 4 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed.

Independent claim 1 is presently amended to recite "…a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof…"

As explained herein at **II**, claim 1 is patentable over Felsvang and Nelson. Srinivasachar mentions treating activated carbon with halide salts or halogen acids prior to placing the activated carbon into flue gas. See, col. 6, lines 2-20. However, like Nelson, Srinivasachar fails to describe or suggest promotion of activated carbon in flue gas, and also fails to describe or suggest that HBr or Br^- have the same or greater effectiveness for mercury removal when used to treat activated carbons than chlorides. Accordingly, there would be no motivation for a person of ordinary skill in the art to use Srinivasachar's bromide additives in Felsvang's process. Further, there is no way to determine from Srinivasachar that in-flight promotion with bromide promoters is more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas (as explained herein at **III(B)(1)**), or that in-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride-promoters (as explained herein at **III(C)(1)**). Additionally, even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas as used in Nelson and Srinivasachar, they would not determine that in-flight promotion provides the same or better mercury removal properties, as explained herein at **III(D)**. As such, Srinivasachar fails to remedy

the deficiencies of Felsvang and Nelson. Therefore, claim 1 is patentable over Felsvang in view of Nelson and Srinivasachar.

Claim 4 is dependent on independent claim 1. As such, claim 4 incorporates all the features of claim 1. Accordingly, dependent claim 4 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 4 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson and Srinivasachar.

IV. The Office Action rejected claim 9 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed.

Independent claim 1 is presently amended to recite "...a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof...."

As explained herein at **II**, claim 1 is patentable over Felsvang and Nelson. As explained herein at **III**, Srinivasachar fails to remedy the deficiencies of Felsvang and Nelson. Therefore, claim 1 is patentable over Felsvang in view of Nelson and Srinivasachar.

Dependent claim 9 is dependent on independent claim 1. As such, claim 9 incorporates all the features of claim 1. Accordingly, dependent claim 9 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 9 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson and Srinivasachar.

V. The Office Action rejected claim 10 under 35 U.S.C. § 103(a) over U.S. patent no. 5,435,980 ("Felsvang") in view of U.S. patent publication no. 2004/0003716 ("Nelson") and U.S. patent no. 6,136,749 ("Gadkaree").

This rejection is respectfully traversed.

Independent claim 1 is presently amended to recite "...a promoter that comprises [[Br_2,]]HBr, Br^-, or a combination thereof...."

As explained herein at **II**, claim 1 is patentable over Felsvang and Nelson. Gadkaree mentions forming activated carbons in the presence of an alkali metal halide co-catalyst, see, claims 1 and 10. Gadkaree's Examples use KI or $SnCl_2$, and Gadkaree fails to describe or suggest relative mercury removal activities of activated carbons treated with bromide versus other halide additives. Gadkaree fails to describe or suggest promotion of activated carbon in flue gas, and does not even specifically mention bromide or bromine additives. Therefore, like Nelson, Gadkaree also fails to describe or suggest that HBr or Br^- have the same or greater effectiveness for mercury removal when used to treat activated carbons than chlorides. Accordingly, Gadkaree fails to remedy the deficiency of Nelson and Felsvang explained herein at **III(A)** that there would be no motivation for a person of ordinary skill in the art to use Nelson's bromide additives in Felsvang's process. Further, there is no way to determine from Gadkaree that in-flight promotion with bromide promoters is more effective for mercury removal than treating the sorbent with bromide or bromine additives outside the mercury-containing gas (as explained herein at **III(B)(1)**), or that in-flight promotion with bromide promoters is more effective for mercury removal than in-flight promotion with chloride-promoters (as explained herein at **III(C)(1)**). Additionally, Gadkaree fails to remedy the deficiency of Nelson and Felsvang explained herein at **III(A)** that even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas as used in Nelson, they would not determine that in-flight promotion provides the same or better mercury removal properties. As such, Gadkaree fails to remedy the deficiencies of Felsvang and Nelson. Therefore, claim 1 is patentable over Felsvang in view of Nelson and Gadkaree.

Dependent claim 10 is dependent on independent claim 1. As such, claim 10 incorporates all the features of claim 1. Accordingly, dependent claim 1 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 10 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson and Gadkaree.

Double Patenting Rejection

VI(A). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-30 of U.S. patent no. 7,435,286 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-30 of U.S. patent no. 7,435,286 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(B). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-25 of U.S. patent no. 8,168,147 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-25 of U.S. patent no. 8,168,147 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(C). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-60 of U.S. patent no. 8,512,655 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-60 of U.S. patent no. 8,512,655 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(D). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-60 of U.S. patent no. 8,821,819 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-60 of U.S. patent no. 8,821,819 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(E). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-33 of U.S. patent no. 9,757,689 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-33 of U.S. patent no. 9,757,689 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(F). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of U.S. patent no. 9,468,886 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of U.S. patent no. 9,468,886 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(G). The Office Action rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-30 of U.S. patent no. 8,652,235 in view of U.S. patent no. 5,435,980 ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-30 of U.S. patent no. 8,652,235 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(H). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-16 of copending application no. 15/295,594 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-16 of copending application no. 15/295,594 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(I). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 8-20 of copending application no. 15/589,359.

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 8-20 of copending application no. 15/589,359.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(J). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/853,029 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of copending application no. 15/853,029 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(K). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 14/712,558.

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of copending application no. 14/712,558.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(L). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/951,970.

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of copending application no. 15/951,970.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(M). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/382,114 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of copending application no. 15/382,114 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(N). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/853,029 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of copending application no. 15/853,029 in view of Felsvang and Nelson. This rejection appears to be a duplicate of the rejection listed herein at **VI(J)**.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

VI(O). The Office Action provisionally rejected claims 1-10, 14, and 21-25 on the ground of nonstatutory double patenting over claims 1-20 of copending application no. 15/978,760 in view of ("Felsvang") and U.S. patent publication no. 2004/0003716 ("Nelson").

This rejection is respectfully traversed. Applicant does not admit that claims 1-10, 14, and 21-25 are obvious over claims 1-20 of copending application no. 15/978,760 in view of Felsvang and Nelson.

As the current pending claims stand rejected on other grounds and are still subject to amendment, Applicant takes note of these rejections but do not take further action at this time

inasmuch as no pending claim has yet to be allowed. Applicant will re-evaluate this rejection, upon an indication of allowable claims.

CONCLUSION

It is respectfully submitted that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone the undersigned at (612) 349-9580 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402-0938
(612) 373-6900

Date December 3, 2018

By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Amber Orlando
Serial No.: 15/974,343	Group Art Unit: 1776
Filed: May 8, 2018	Docket: 4820.001US9
Customer No.: 21186	Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(c)(2), Applicant hereby authorizes the Commissioner to charge the fee of $240.00 as set forth in 37 C.F.R. § 1.17(p), to Deposit Account No. 19-0743. Please charge any additional fees or deficiencies, or credit any overpayment to Deposit Account No. 19-0743.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date December 3, 2018 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:mlr1

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-10,130,930	11/20/2018	Olson, Edwin S
	US-20180229182A1	8/16/2018	Olson, Edwin S., et al.
	US-20180280870A1	10/4/2018	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 14/712,558, Non Final Office Action mailed 10-19-18", 26 pgs	
	"Application Serial No. 14/712,558, Non-Final Office Action mailed 10-19-18", 35 pgs	
	"Application Serial No. 14/712,558, Response filed 08-14-18 to Non Final Office Action mailed 07-02-18", 11 pgs	
	"Application Serial No. 15/295,594, Non Final Office Action mailed 10-23-18", 20 pgs	
	"Application Serial No. 15/382,114, Response filed 09-12-18 to Restriction Requirement mailed 08-28-18", 8 pgs.	
	"Application Serial No. 15/382,114, Restriction Requirement mailed 08-28-18", 9 pgs	
	"Application Serial No. 15/589,359, Final Office Action mailed 09-12-18", 14 pgs	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 10-22-18", 12 pgs	
	"Application Serial No. 15/589,359, Response filed 09-14-18 to Final Office Action mailed 09-12-18", 18 pgs.	
	"Application Serial No. 15/978,760, Non Final Office Action mailed 10-10-18", 17 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 11-02-18", 27 pgs	
	"Application Serial No. 15/997,091,Response filed 08-14-2018 to Non Final Office Action mailed 07-27-18", 10 pgs	
	PIETRZAK, et al., "Preparation of nitrogen-enriched activated carbons from brown coal", Energy and Fuels 20.3, (2006), 1275-1280	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/974,343 Group Art Unit: 1776
Filed: May 8, 2018 Docket No.: 4820.001US9
Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

I, John Pavlish, declare and say as follows:

1. I have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member

of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

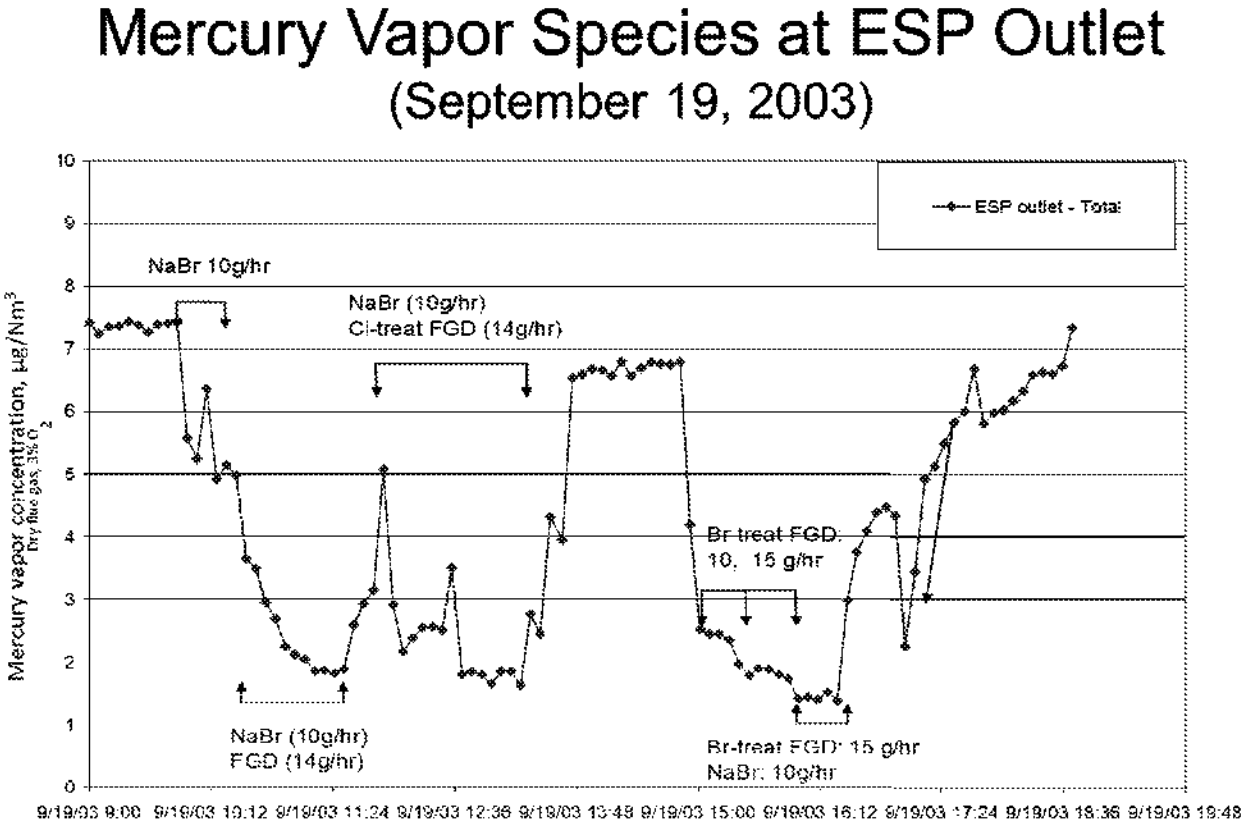
2. A bromine-treated activated carbon was prepared by exposing activated carbon (Norit DARCO® FGD) to gaseous bromine. A cement mixer was used to expose the activated carbon to the bromine gas. Tumbling vanes produced a dispersion of the activated carbon within the barrel. A cover was fit over the opening to keep the activated carbon dispersion inside the barrel. In the center of the lid, a small hole was drilled, and a tube extended to the center of the barrel. The tube was attached to a source of bromine vapor (Br_2) in dry nitrogen via a swivel so that the tube in the barrel would rotate and the tube to the source would be stationary. A charge of 1 to 5 kg of the activated carbon was weighed and transferred to the barrel. The weight of bromine transferred to the barrel was equal to 5 weight % of the amount of activated carbon.

3. An HCl-treated activated carbon was prepared by exposing activated carbon (Norit DARCO® FGD) to gaseous HCl. The carbon was weighed and added to a flask which was attached to a rotary apparatus. A hard-plastic tube was inserted into the condenser end of the apparatus for introduction of the HCl/nitrogen gas mix. This extended to the center of the flask. HCl from a cylinder was run through a flow meter and mixed with a low flow of nitrogen in a T-tube attached to the inlet tube. The flow rate was set to provide 5 wt % HCl over 15 minutes exposure. The flask was slowly rotated in the apparatus at room temperature so that the carbon turned over but did not exit the flask. After the exposure period, the HCl flow was stopped and the HCl-treated activated carbon was removed.

4. A pilot-scale 550,000-Btu/hr pulverized coal (pc)-fired test unit was used to combust lignite coal and test mercury control using various sorbents. The coal combustion flue gas exiting the pilot unit was cooled down to a nominal temperature of 49°C (300°F) and then was introduced into a single wire tubular ESP unit. Activated

carbon sorbents were fed with a K-Tron dual-screw feeder upstream of the ESP. The feeder was calibrated prior to the start of each carbon injection test. Before Hg control testing began, a baseline condition was established with the pilot-scale unit, and flue gas mercury content was measured. The mercury content at the ESP outlet was measured with NaBr on coal, with NaBr on coal with injection of untreated activated carbon (Norit DARCO® FGD) into the flue gas, with NaBr on coal with injection of the HCl-treated activated carbon from the procedure at item 3, with injection of the Br_2-treated activated carbon from the procedure at item 2 without additives on the coal, and with NaBr on the coal with injection of the Br_2-treated activated carbon from the procedure at item 2.

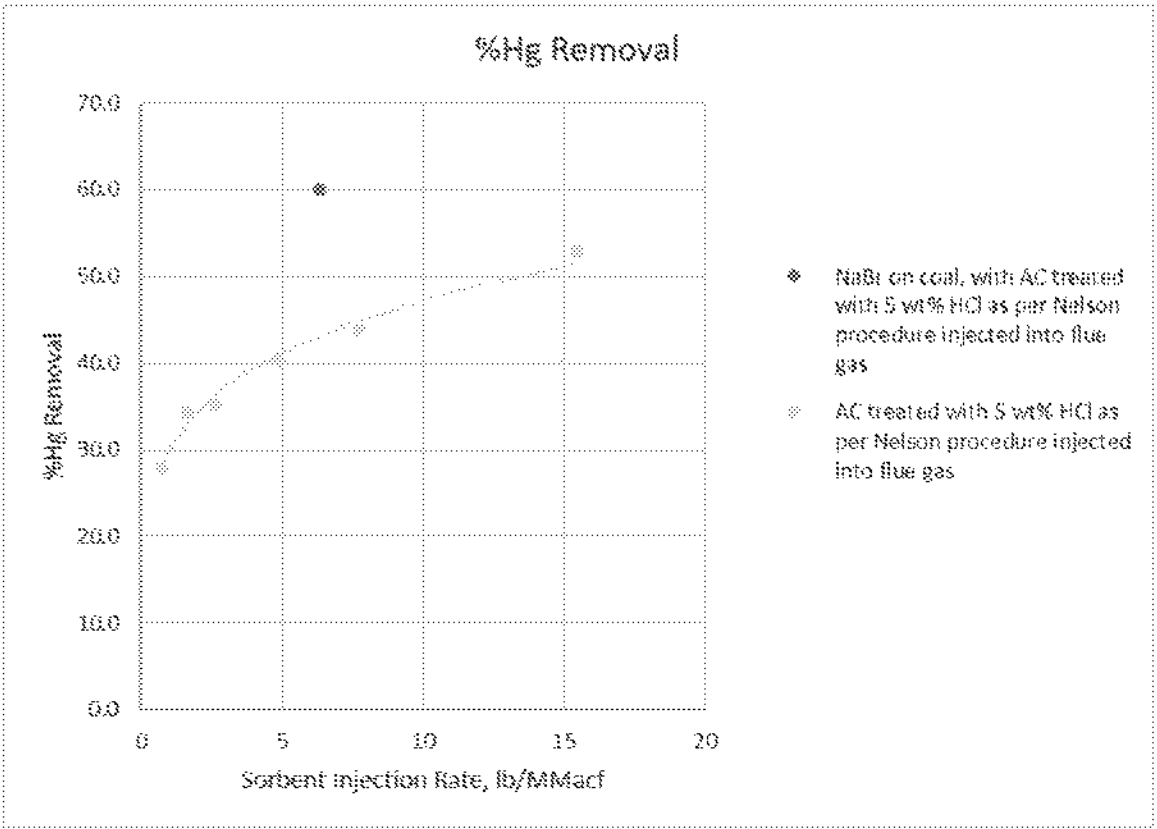
5. A plot showing the amount of mercury in the ESP outlet versus time from the procedure described at item 4 is shown below.



6. The data in the plot at item 5 shows that, compared to placing NaBr on the coal and injecting untreated activated carbon into the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas provided greater mercury removal. The data in the plot above also shows that, compared to injecting activated carbon into the flue gas treated with 5 wt% Br_2 outside the flue gas, and compared to placing NaBr on the coal and injecting untreated activated carbon into the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% Br_2 outside the flue gas provided greater mercury removal. Therefore, in-flight promotion of activated carbon with bromide in the flue gas provides even greater mercury removal if the activated carbon has already been treated with Br_2 or HCl outside the flue gas prior to injection. In-flight bromide promotion in the flue gas of activated carbon treated with Br_2 outside the flue gas also provides greater mercury removal than injecting activated carbon treated with Br_2 outside the flue gas with no in-flight bromide promotion.

7. The procedure from item 4 was repeated, using NaBr on coal with injection of the HCl-treated activated carbon from the procedure at item 3, and with injection of the HCl-treated activated carbon from the procedure at item 3 without NaBr on coal.

8. A plot showing the percent mercury removal versus the sorbent injection rate from the procedure described at item 7 is shown below.



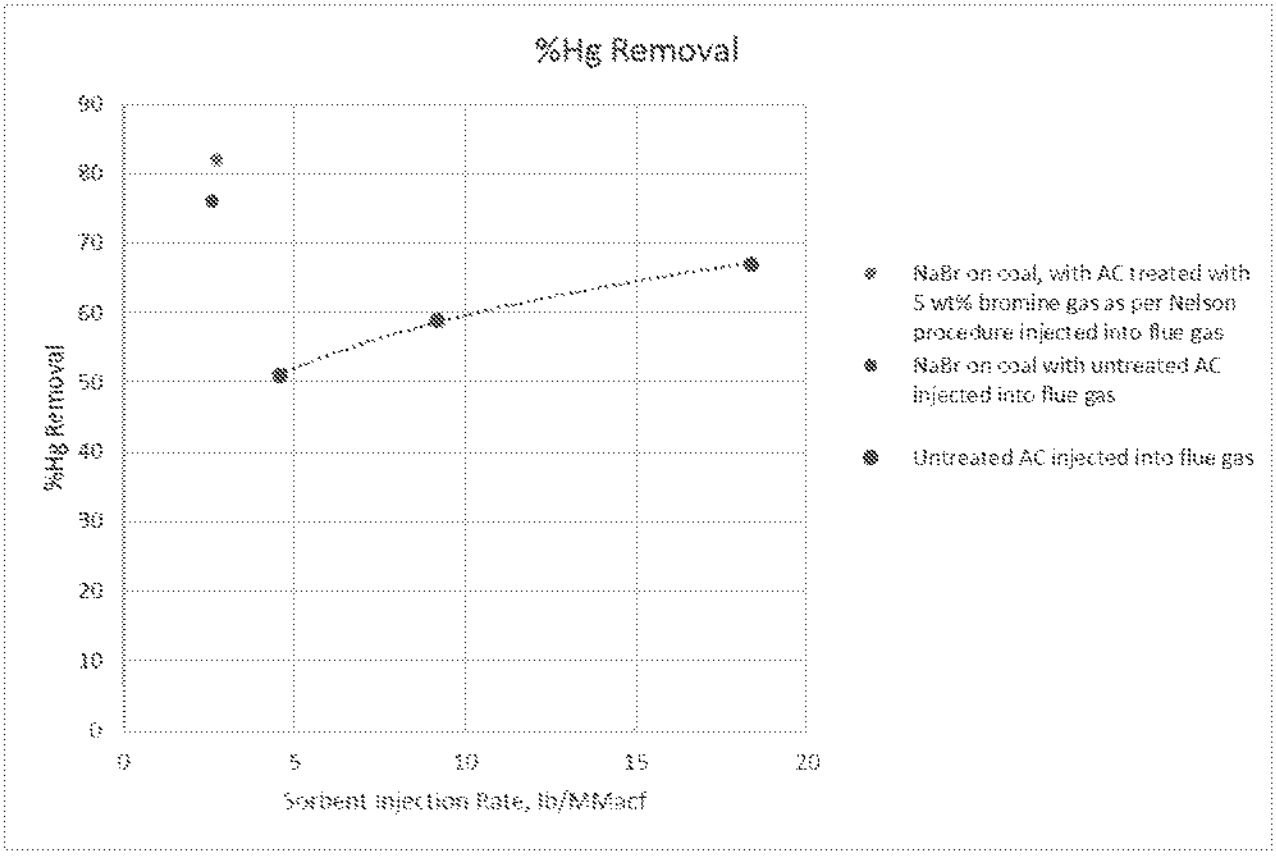
9. The data in the plot at item 8 shows that, compared to injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas, placing NaBr on the coal and injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas provided greater mercury removal. Therefore, in-flight bromide promotion in the flue gas of activated carbon treated with HCl outside the flue gas provides greater mercury removal than injecting activated carbon treated with HCl outside the flue gas with no in-flight bromide promotion.

10. A bromine-treated activated carbon was prepared by following the procedure described at item 2, but using Norit DARCO® Hg activated carbon in place of Norit DARCO® FGD. Norit DARCO® Hg is an activated carbon that a Norit Americas technical representative told me was rebranded for mercury control applications and was previously referred to as Norit DARCO® FGD.

11. An HCl-treated activated carbon was prepared by following the procedure described at item 3, but using exposing using Norit DARCO® Hg activated carbon in place of Norit DARCO® FGD.

12. The procedure from item 4 was repeated, using subbituminous coal. Testing was performed using injection of untreated activated carbon (Norit DARCO® Hg) into the flue gas, NaBr on coal with injection of untreated activated carbon (Norit DARCO® Hg) into the flue gas, and using NaBr on coal with injection of the Br_2-treated activated carbon from the procedure at item 10 into the flue gas.

13. A plot showing the percent mercury removal versus the sorbent injection rate from the procedure described at item 12 is shown below.

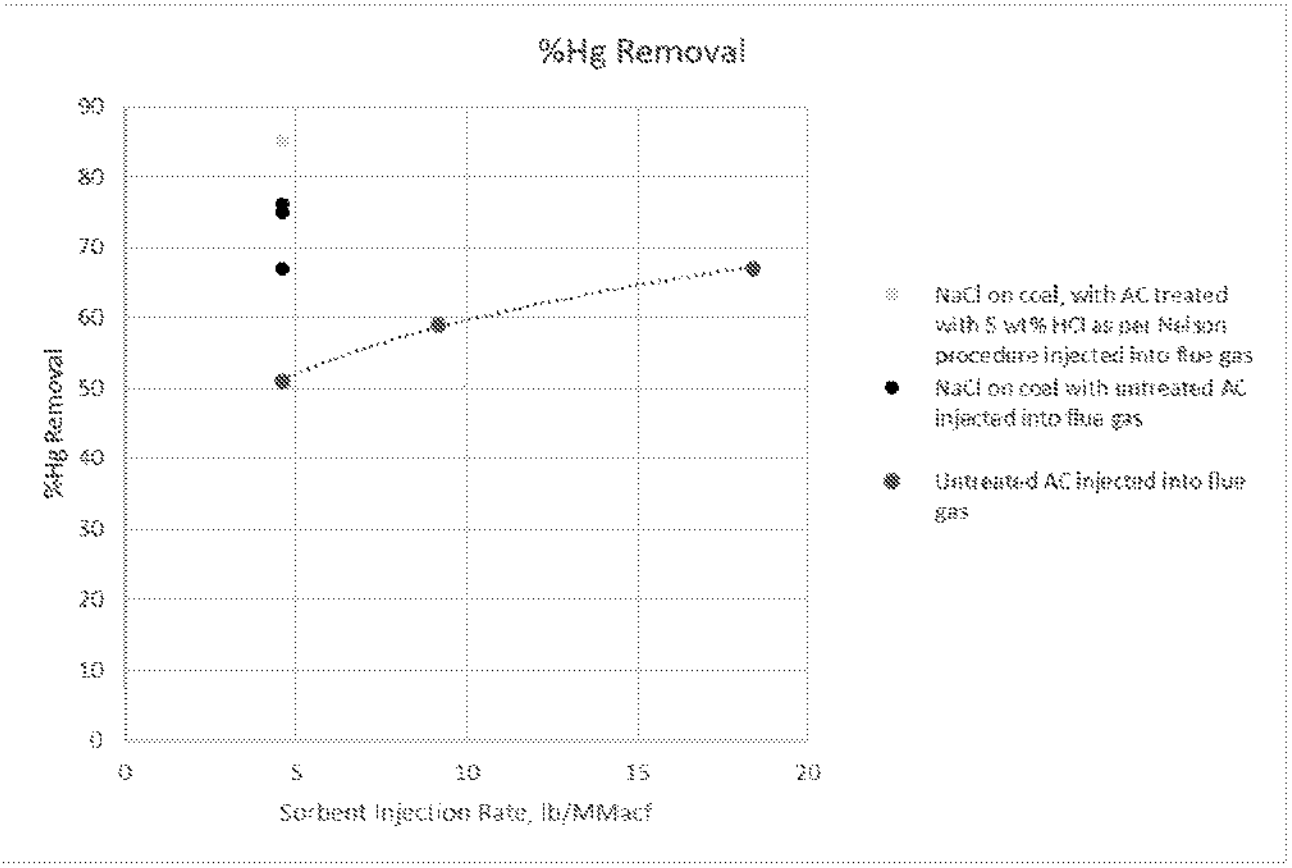


14. The data in the plot at item 13 shows that, compared to placing NaBr on the coal and injecting untreated activated carbon into the flue gas, placing NaBr on the coal and

injecting activated carbon into the flue gas treated with 5 wt% Br_2 outside the flue gas provided greater mercury removal. Therefore, in-flight promotion of activated carbon with bromide in the flue gas provides even greater mercury removal if the activated carbon has already been treated with Br_2 outside the flue gas prior to injection.

15. The procedure of item 12 was repeated, using injection of untreated activated carbon into the flue gas, NaCl on coal with injection of untreated activated carbon (Norit DARCO® Hg) into the flue gas, and using NaCl on coal with injection of the HCl-treated activated carbon from the procedure at item 11 into the flue gas.

16. A plot showing the percent mercury removal versus the sorbent injection rate for the procedure described at item 15 is shown below.



17. The data in the plot at item 16 shows that, compared to placing NaCl on the coal and injecting untreated activated carbon into the flue gas, placing NaCl on the coal and injecting activated carbon into the flue gas treated with 5 wt% HCl outside the flue gas provided greater mercury removal. Therefore, in-flight promotion of activated carbon with chloride in the flue gas provides even greater mercury removal if the activated carbon has already been treated with chloride outside the flue gas prior to injection.

18. The data herein show trends that provide evidence that using activated carbon treated with bromide additives outside the flue gas and subsequently injected into the flue gas containing bromide promoters for in-flight promotion results in greater mercury removal than using activated carbon only treated with bromide additives outside the flue gas or activated carbon only treated with bromide promoters in-flight in the flue gas. Although the additives used to treat injected activated carbon herein are HCl or Br_2, the trends shown would be expected to occur also with bromide-treated activated carbon.

19. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and/or any patent issued thereon.

Dated: December 3, 2018 By: John Pavlish

John Pavlish

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Steven M. Reid/Megan Reed
Attorney Docket Number:	4820.001US9

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	34470321
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Steven M. Reid/Megan Reed
Filer Authorized By:	Steven M. Reid
Attorney Docket Number:	4820.001US9
Receipt Date:	03-DEC-2018
Filing Date:	08-MAY-2018
Time Stamp:	17:45:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	120418INTEFSW00004943190743
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIGNED_4820_001US9_NFOAR espSIDS_Dec.pdf	1255739 b800353ecc9dcde8775306c5a397bb9a5ef828d0	yes	49

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Amendment/Req. Reconsideration-After Non-Final Reject	2	2
Claims	3	5
Applicant Arguments/Remarks Made in an Amendment	6	38
Transmittal Letter	39	40
Information Disclosure Statement (IDS) Form (SB08)	41	41
Affidavit-traversing rejectns or objectns rule 132	42	49

Warnings:

Information:

2	Non Patent Literature	4820_001US7_aarn_08142018.pdf	145922 4d970a5ffe9fef2a7444f0ddacf9bf5ae5b61138	no	11

Warnings:

Information:

3	Non Patent Literature	4820_001US7_OARN_10192018.pdf	4575545 c1d927fd851e316fbccdcb097d60729d4b55cd8	no	35

Warnings:

Information:

4	Non Patent Literature	4820001U10_OARNPE_11022018.pdf	2761437 34c549c6cdc94728be5b6de758cfb298d81339a5	no	27
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5	Non Patent Literature	4820001U10_rsp_20180814.pdf	139078 b885eace8cc9592c3beaceef426960d4b66d32c1	no	10
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Information:					
6	Non Patent Literature	4820001US7_OARN_10192018.pdf	2852544 4eeba85b888a3d31b679e1ee641d3bcdb01ff776	no	26
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Information:					
7	Non Patent Literature	4820003US2_AARF_091418.pdf	158598 8e81e9d62c0e34c49c268ab4bbc2ec2e60a47797	no	14
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Information:					
8	Non Patent Literature	4820003US2_FOAR_09122018.pdf	1184529 2389c12c7182e9a25f5d417bb4a92ef6ab2cf773	no	14
Warnings:					
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9	Non Patent Literature	4820003US2_OARN_10222018.pdf	993980 716b1e9eb168c280dbdf5217532fb1b656cd494d	no	12
Warnings:					
Information:					
10	Non Patent Literature	4820004US1_RERR_08282018.pdf	853637 428ed9cc115f2c097775418ae9bcffe521295a471	no	9
Warnings:					
Information:					

11	Non Patent Literature	4820004US1_RRR1MO_091218.pdf	129340 ddb08fabb6d6f8a0fefc6b0ca33e8b4e63ec1683	no	8
Warnings:					
Information:					
12	Non Patent Literature	4820007US3_OARN_10232018.pdf	2099174 c497166d6706900dde2aafba6f1d521e03a7d45e	no	20
Warnings:					
Information:					
13	Non Patent Literature	4820007US4_OARNPE_10102018.pdf	1857201 90533c77a7653ec28595acaf94e17e1e124776f1	no	17
Warnings:					
Information:					
14	Non Patent Literature	Pietrzak_PrepartionofNitrogen.pdf	219945 1e49393d4d8b8549b6da2d6bc71a5db44ff08e432	no	6
Warnings:					
Information:					
15	Fee Worksheet (SB06)	fee-info.pdf	30342 1afd28c07bbd2e3f76e93e39e1f16e14b15fd457	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	19257011		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	January 29, 2018
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Amendment and Response under 37 C.F.R. § 1.111 (37 pgs.)
X Supplemental Information Disclosure Statement (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (13).
X Authorization to charge Deposit Account 19-0743 in the amount of $240.00 to cover the fee for consideration of Information Disclosure Statement under 37 C.F.R. § 1.97(c).
X Declaration Under 37 C.F.R. § 1.132 (8 pgs)

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 10/29/2018

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
10/29/2018	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Office Action Summary	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA 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 08/14/2018.

☐ 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) 1-10,14 and 21-25 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) 1-10,14 and 21-25 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 _____ 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 § 112

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 7 and 23-25 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 1 recites the limitation "the sorbent material" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim 7 recites the limitation "the sorbent material" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 23 recites the limitation "the sorbent" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 24 recites the limitation "the sorbent material" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 25 recites the limitation "the sorbent" in line 6. There is insufficient antecedent basis for this limitation in the claim.

Claim 25 recites the limitation "the sorbent composition" in line 6. There is insufficient antecedent basis for this limitation in the claim.

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 following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in

order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

Claim 1-3 and 5-8, 14 and 21-25 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 in view of Nelson Jr. US 2004/0003716.

For claim 1, the Felsvang et al. reference discloses a method for separating mercury from a mercury-containing gas, the method comprising: combusting a mixture of coal and an additive that has been added to the coal to form the mercury-containing gas (column 5, lines 23-25, lines 60-65 and column 4, lines 42-45), adding a particulate sorbent material comprising activated carbon into the mercury-containing gas (column 6, lines 11-14 and lines 24-26); chemically reacting mercury in the mercury-containing gas with the sorbent material, to form a mercury-sorbent (column 6, lines 24-28); and separating the mercury-sorbent from the mercury-containing gas (column 5, lines 57-65). The reference does not disclose the additive comprising a bromide compound, promoting at least a portion of the sorbent material by chemically reacting the sorbent material with Br_2, HBr, Br^-, or a combination thereof in-flight, to form a promoted sorbent material.

The Nelson reference discloses the additive comprising a bromide compound (Nelson paragraphs [0017] and [0041]).

It would have been obvious to one having ordinary skill in the art to have modified the Felsvang et al. reference to either replace the Cl with or include in addition to the Cl, a bromide compound including Br_2, HBr, Br^-, or a combination (Nelson paragraphs [0017] and [0041]) so as to provide an effective carbon sorbent for mercury.

The combination of references above would result in promoting at least a portion of the sorbent material (activated carbon as shown in Felsvang column 4, lines 5-11) by chemically reacting the sorbent material with Br_2, HBr, Br^- (the combination of the halogen/halide of both Nelson and Felsvang et al. i.e. the Cl or Br compounds as described within Felsvang et al. and Nelson), or a combination thereof in-

flight (Felsvang et al. column 4, lines 39-50 and 5-11), to form a promoted sorbent material. As each of the components are described in the above references the combination of the components would have the same effect, i.e. reacting to form the promoted sorbent. The examiner also points to Felsvang et al. which discloses that the halogen and the activated carbon exhibit a synergistic effect enabling an extremely efficient Hg removal (column 6, lines 8-11).

For claim 2, the Felsvang reference discloses mixing the additive and the coal before combusting the coal (column 4, lines 42-45).

For claim 3, the Nelson reference discloses the additive mixed with the coal is in a liquid (paragraph [0064]).

For claims 5 and 6, and as detailed above, each of the claimed steps is disclosed by the combination of Felsvang and Nelson reference and therefor the result of performing the steps would inherently be the same and would result in the promoted sorbent material comprises active sites, wherein the active sites comprise halide anions bound to the activated carbon and the promoted sorbent material comprises active sites, wherein the active sites comprise carbocations bound to halide anions.

For claims 7 and 8, the promoted sorbent is disclosed by the combination of Felsvang and Nelson as disclosed above. Each of the steps as claimed are also disclosed by Felsvang and Nelson and would inherently have the same results when the method is performed i.e. chemically reacting the sorbent material with the additive in the mercury-containing gas comprises chemically reacting carbene species edge sites in the activated carbon with the additive and carbocations in the activated carbon of the mercury-sorbent accept electrons from mercury atoms of the mercury-sorbent.

For claim 14, the Felsvang et al. reference discloses the activated carbon is chosen from powdered activated carbon, granular activated carbon, carbon black, carbon fiber, aerogel carbon, pyrolysis char, and combinations thereof (column 3, lines 5-23).

For claim 21, the Felsvang et al. reference discloses that the coal and the additive are mixed prior to the combustion step as well as the combustion furnace where combustion occurs (column 3 lines 43-47 and column 4, lines 23-26). The examiner asserts that this would include coal and the additive being mixed at a location upstream of a combustion furnace where combustion occurs. Further while the reference does not explicitly state "at a location upstream of the combustion furnace" it would be well within the level of ordinary skill in the art to modify the Felsvang et al. reference to include the coal and the additive being mixed at a location upstream of the combustion furnace as this does not fundamentally change the reaction step and is merely a rearrangement of parts/steps.

For claims 22 and 23, the Felsvang et al. reference discloses separating greater than 70 wt% of the mercury from the mercury-containing gas on the sorbent (examples 1, 3 and 4). Further the examiner asserts that these limitations are the result of the method. As the method is disclosed by Felsvang et al. and Nelson as shown above, the result of such a combination would occur i.e. separating greater than 70 wt% of the mercury from the mercury-containing gas on the sorbent.

For claim 24, the Felsvang et al. reference does not explicitly state the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon. The reference does disclose optimizing the amount of Cl and activated carbon introduced (column 6, lines 42-46).

Further the Nelson reference also discloses optimizing of additive so as to obtain a desired mercury reactivity (paragraph [0054]).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Felsvang et al. reference to include state the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon (Felsvang et al. column 6, lines 42-46 and Nelson paragraph [0054]) so as to adjust the amount of halogen introduced based on the Hg content and to ensure optimum reaction between the halogen and the activated

carbon. Further the courts have held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

For claim 25, the Felsvang et al. reference discloses the method is a method for reducing mercury in the mercury-containing gas to a desired level, wherein separating the mercury-sorbent from the mercury-containing gas forms a cleaned gas (column 5, lines 45-50), the method further comprising: monitoring the mercury content of the cleaned gas; and controlling, in response to the monitored mercury content of the cleaned gas, an introduction rate (amount would include introduction rate) of the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that, the mercury content of the cleaned gas is maintained at or below the desired level (column 6, lines 42-47).

The Felsvang et al. reference does not disclose injection as a means of introduction.

The Nelson reference discloses injection (abstract).

It would have been obvious to one having ordinary skill in the art to modified Felsvang et al. to have the means of introduction be injection (Nelson abstract) so as to allow for the components of the system to be entered into the system.

Claim 4 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716 as applied in claim 3 above and further in view of Srinivasachar et al. US 6,848,374.

For claim 4, the Felsvang and Nelson combination does not disclose the liquid is a hydrocarbon, a chlorinated hydrocarbon, supercritical carbon dioxide water, salt solution, or a combination thereof.

The Srinivasachar et al. reference discloses the liquid is a salt solution (column 6, lines 5-10).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Felsvang and Nelson combination to include the liquid is a salt solution

(Srinivasachar et al. column 6, lines 5-10) so as to allow the halogen to be sprayed and therefore deposited on the sorbent particles.

Claim 9 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716 as applied in claim 1 above and further in view of Srinivasachar et al. US 6,848,374.

For claim 9, the Felsvang and Nelson combination does not disclose wherein the additive is substantially in vapor form in the mercury-containing gas.

The Srinivasachar et al. reference discloses wherein the additive is substantially in vapor form in the mercury-containing gas (column 6, lines 13-18).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Felsvang and Nelson combination to include wherein the additive is substantially in vapor form in the mercury-containing gas (Srinicasachar et al. column 6, lines 13-18) so as to allow the halogen to deposited on the sorbent particles via condensing/adsorbing.

Claim 10 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716 as applied in claim 1 above and further in view of Gadkaree US 6,136,749.

The combination of Felsvang et al. and Nelson do not disclose the additive comprises Ca, Na, or a combination thereof.

The Gadkaree reference discloses the additive comprises Ca, Na, or a combination thereof (column 3, lines 58-65 and claim 10).

It would have been obvious to one having ordinary skill in the art to have modified the Felsvang et al. and Nelson combination to include the additive comprises Ca, Na, or a combination thereof (Gadkaree column 3, lines 58-65 and claim 10) so as to enhance the activity of the activated carbon catalyst.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A

web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. US 7,435,286 ('286) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '286 except for combusting a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '286 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-25 of U.S. Patent No. US 8,168,147 ('147) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '147 except a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '147 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-60 of U.S. Patent No. US 8,512,655 ('655) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '655 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '655 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-60 of U.S. Patent No. US 8,821,819 ('819) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '819 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '819 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-33 of U.S. Patent No. US 9,757,689 ('689) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '689 except combusting a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '689 reference to include combusting a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of U.S. Patent No. US 9,468,886 ('886) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '886 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '886 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. 8,652,235 ('235) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '235 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '235 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of copending Application No. 15/295594 ('594) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '594 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '594 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 8-20 of copending Application No. 15/589359 ('359).

Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording it the limitations correspond to '359.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/853029 ('029) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '029 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '029 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 14/712558 ('558) Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording it the limitations correspond to '558.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/951970 ('970).

Although the claims at issue are not identical, they are not patentably distinct from each other because while the current claim set includes different wording, the limitations correspond to '970.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/382114 ('114) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '114 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '114 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/853029 ('029) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '029 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '029 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claims 1-10, 14 and 21-25 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/978,760 ('760) in view of Felsvang et al. US 5,435,980 and Nelson Jr. US 2004/0003716.

The current claim set corresponds to '760 except for a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas.

Felsvang et al. and Nelson references disclose this limitation as shown above.

It would have been obvious to one having ordinary skill in the art to have modified the '760 reference to include a mixture of coal and an additive, the additive comprising a bromide compound that has been added to the coal, to form the mercury-containing gas (Felsvang et al. column 5, 60-65 and column 4, lines 42-45 and Nelson paragraphs [0017] and [0041]) so as to supplement the halogen content of the system so as to increase the mercury sorption capability.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Response to Arguments

Applicant's arguments with respect to claims 1-10, 14 and 21-25 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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.

AMBER ROSE. ORLANDO
Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Notice of References Cited	Application/Control No. 15/974,343	Applicant(s)/Patent Under Reexamination	
	Examiner AMBER R ORLANDO	Art Unit 1776	Page 1 of 2

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*	A	US-5435980-A	07-1995	Felsvang; Karsten S.	B01D53/10	423/210
*	B	US-5569436-A	10-1996	Lerner; Bernard J.	B01D53/64	110/235
*	C	US-6136749-A	10-2000	Gadkaree; Kishor P.	B01D53/8665	502/180
*	D	US-6372187-B1	04-2002	Madden; Deborah A.	B01D53/508	110/345
*	E	US-6558454-B1	05-2003	Chang; Ramsay	B01D53/10	110/342
*	F	US-20040003716-A1	01-2004	Nelson, Sidney G. JR.	B01D53/02	95/134
*	G	US-6719828-B1	04-2004	Lovell; John S.	B01D53/02	423/210
*	H	US-20040086439-A1	05-2004	Vosteen, Bernhard	B01D53/64	423/210
*	I	US-6818043-B1	11-2004	Chang; Ramsay	B01D53/64	423/213.2
*	J	US-6848374-B2	02-2005	Srinivasachar; Srivats	B01D53/10	110/165R
*	K	US-20060048646-A1	03-2006	Olson; Edwin S.	B01D53/10	95/134
*	L	US-20070180990-A1	08-2007	Downs; William	B01D53/10	95/134
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	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.

Notice of References Cited	Application/Control No. 15/974,343	Applicant(s)/Patent Under Reexamination	
	Examiner AMBER R ORLANDO	Art Unit 1776	Page 2 of 2

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*	B	US-20090320678-A1	12-2009	Chang; Ramsay	B01D46/002	95/92
*	C	US-7780765-B2	08-2010	Srinivasachar; Srivats	B01D53/10	110/203
*	D	US-20150098878-A1	04-2015	Olson; Edwin S.	B01J20/12	423/210
*	E	US-20170100692-A1	04-2017	Olson; Edwin S.	B01D53/08	1/1
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*	G	US-20180133646-A1	05-2018	Pavlish; John H.	B01J20/3416	1/1
*	H	US-20180257031-A1	09-2018	Olson; Edwin S.	B01J20/3416	1/1
*	I	US-4013516-A	03-1977	Greenfield; Charles	C10B47/30	159/905
*	J	US-4699896-A	10-1987	Sing; Kenneth S. W.	B01J21/18	264/29.2
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	L					
	M					

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	N					
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	P					
	Q					
	R					
	S					
	T					

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	V	
	W	
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*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
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO
Inventor Search (EAST)	10/24/2018	AO
Text Search (SEE EAST SEARCH HISTORY)	10/24/2018	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	45	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S2	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorben and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S3	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:20
S7	73	("20020150516" | "4786483" | "5409522" | "5505766" | "6383981" | "6878358" | "20020033097" | "4530765" | "5346674" | "6080281" | "4708853" | "6027551" | "6136072" | "6258334" | "6818043" | "20060057044" | "20080207443" | "20010002387" | "3826618" | "4814152" | "4820318" | "4889698" | "5891324" | "6528030" | "20050227146" | "5419834" | "7942566" | "20080134888" | "3662523" | "3849267" | "4196173" | "4500327" | "6942840" | "20020134242" | "20030136509" | "20050147549" | "20060112823" | "20080134888" | "6471936" | "20010003116" | "20050019240" | "20060048646" | "4956162" | "5575982" | "6372187" | "6375909" | "7435286" | "7514052" | "20050074380" | "20090081092" | "5288306" | "1984164" | "4101631" | "5695726" | "6080281" | "6848374" | "20050000197" | "5300137" | "5607496" | "5672323" | "6214304" | "6953494" | "5245120" | "20070168213" | "7938571" | "20040003716" | "20040013589" | "3194629" | "3786619" | "5827352" | "20040109800" | "20070295347" | "5435980" | "6136749" | "20030206846").PN.	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:25
S8	13	"11209163"	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S9	3	"11209163" and non carbon	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S10	161	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:49
S11	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50

		sorbent and promoter and activated carbond and mercury				
S12	116	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S13	172	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S14	67	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S15	67	"6136749"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:11
S16	20	"684374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S17	1	"20040003716"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S18	68	"6848374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S19	41	"7435286"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S20	13	"8168147"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S21	69	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S22	181	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S25	28	"5266280"	US-PGPUB; USPAT	ADJ	ON	2016/06/07 13:41
S26	281	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:01
S27	148	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:02
S28	159	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:18
S29	206	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2016/09/29 16:22

		activated carbon	EPO; JPO; DERWENT; IBM_TDB			
S30	195	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/09/30 13:48
S33	6	"20040003719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:56
S34	49	"2004003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:57
S35	81	"6848374"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:58
S36	56	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:02
S37	7	olson.in. and ("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:04
S38	0	("40" microns and halocarbon sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S39	0	(halocarbon sorbent).clm. and "40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S40	65	"40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2016/11/16 11:06

			DERWENT; IBM_TDB			
S41	3907	("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S42	29	("40" microns and sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S43	1	(halocarbon sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S44	36	(sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S45	0	(sorbent).clm. and olson.in. and "40" micron	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S46	17	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:09
S47	2	"20110233133"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:27
S48	7	"20110023427"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:28
S49	15	"2004025274"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2016/11/16 11:32

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S50	11	"20040025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S51	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S52	40	"6312489"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S53	30	("20030024872" | "20050045553" | "20050144916" | "4008060" | "4640779" | "4655921" | "4673503" | "4738778" | "4746432" | "4799944" | "5043000" | "5051118" | "5120296" | "5174896" | "5320657" | "5512075" | "5674302" | "6152979" | "6312489" | "6315130" | "6336946" | "6398836" | "6585793" | "6598749" | "7648546").PN. OR ("7931723").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:36
S54	33	("4200444" | "4640779" | "5968215" | "6059851").PN. OR ("6312489").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:40
S55	5	"8518142"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:54
S56	4	"8747505"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:57
S57	2	"14318270"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 12:06
S58	13	pac with size with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 12:13
S59	197	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/11/16 15:23
S60	0	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10,	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39

		B01D53/10).cpc. and (halogen or halide of HBr) with sorbent "4198388"				
S61	10	"4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S62	0	"2010083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S63	2	"20100083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S64	2	absorp$5 with mea with methanol with acid	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:36
S65	2	"20070283813"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:39
S66	21	"4469596"	US-PGPUB; USPAT	ADJ	ON	2016/11/21 08:29
S67	4	"2003229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S68	2	"20030229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S69	45	"5,338,458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S70	45	"5338458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S71	213	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:02
S72	64	("1786483" | "1984164" | "2317857" | "20010002387" | "20010003116" | "20020134242" | "20020150516" | "20030136509" | "20040003716" | "20040013589" | "20050019240" | "20060048646" | "20060191835" | "20090062119" | "20100047146" | "20120183458" | "20140056787" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "4196173" | "4500327" | "4814152" | "4820318" | "4889698" | "4959162" | "5300137" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" |	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:20

		"5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "7101631" | "7435286" | "7479263" | "7514052" | "7563311" | "7611564" | "8007749" | "8168147" | "8168149" | "8512655").PN.				
S73	3	("20090235848" | "20110076210" | "20150246315").PN.	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:31
S79	3	("20090235848" | "20110076210" | "20140224121").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:36
S80	96	("1984164" | "2317857" | "20010002387" | "20010003116" | "20020043496" | "20020134242" | "20020150516" | "20030104937" | "20030136509" | "20040003716" | "20040013589" | "20040076570" | "20050019240" | "20060048646" | "20060191835" | "20080182747" | "20080292512" | "20090062119" | "20090136401" | "20090320678" | "20100047146" | "20110168018" | "20120183458" | "20130280156" | "20140056787" | "20140255279" | "20140308188" | "20150098878" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "3876393" | "4094777" | "4101631" | "4196173" | "4338896" | "4500327" | "4708853" | "4786483" | "4814152" | "4820318" | "4889698" | "4956162" | "5300137" | "5336835" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" | "5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6638485" | "6808692" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "6960329" | "7081434" | "7211707" | "7435286" | "7479263" | "7514052" | "7521032" | "7544338" | "7563311" | "7611564" | "7622092" | "7722843" | "7767174" | "7780765" | "8007749" | "8168147" | "8168149" | "8216535" | "8512655" | "8652235" | "8821819" | "9011805").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:41
S81	593	honeycomb with plug$4 and plug$4 with length	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S82	0	honeycomb with plug$4 and plug$4 with length with less than with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S83	0	honeycomb with plug$4 and plug$4 with length with less than	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S84	127	honeycomb with plug$4 and plug$4 with length with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:46
S85	241	honeycomb with plug$4 and plug$4 with length with mm	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:47
S86	41	honeycomb with plug$4 and plug$4 with	US-PGPUB;	ADJ	ON	2017/06/27

		length with "3 mm "	USPAT			14:49
S87	28	honeycomb with plug$4 and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:52
S88	28	honeycomb and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:53
S89	43	honeycomb and plug$4 with porosity with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:06
S90	20	honeycomb and plug$4 with pore (size or diameter) with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:07
S91	8	saw with honeycomb with filter	US-PGPUB; USPAT	ADJ	ON	2017/06/29 13:31
S92	230	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/12/01 14:36
S93	2	"20060260468"	US-PGPUB; USPAT	ADJ	ON	2018/07/03 10:34
S94	19	engine with air with inlet with filter$4 with cone	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:26
S95	36	engine with air with inlet with filter$4 with (cone or conical or (diameter with (increas$4 or decreas$4)))	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:27
S96	24	("3771638" | "3870495" | "3872012" | "4157902" | "4702754" | "5125940" | "5522909" | "5549724" | "5632793").PN. OR ("5888260").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S97	41	("0153535" | "0439091" | "1398685" | "1530163" | "1887052" | "2087688" | "4003836" | "4018580" | "4032455" | "4039308" | "4065276" | "4261710" | "4410341" | "4414110" | "4699715" | "5106397" | "5178656" | "5522909" | "5549722" | "5549724" | "5888260" | "6397842" | "6508052" | "D401597" | "D401942" | "D403414" | "D403416").PN. OR ("6808552").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S98	15	("D403416").URPN.	USPAT	ADJ	ON	2018/07/03 15:33
S99	0	"20030089233"	USPAT	ADJ	ON	2018/07/04 12:29
S100	3	"20030089233"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S101	26	"6833023"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S102	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:08
S103	14	carbocations with sorbent with bromine	US-PGPUB; USPAT;	ADJ	ON	2018/07/09 13:14

			USOCR; FPRS; EPO; JPO			
S104	0	a side forming a cross sectional shape of each of the first	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:47
S105	0	non of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S106	0	none of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S107	0	none of sides forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S109	13	olson.in. and (alkali and promoter and earth).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S110	0	olson.in. and (alkali and promoter and earth with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S111	10	olson.in. and (alkali and promoter with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S112	0	"2015008283"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S113	2	"20150082833"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S114	24	olson.in. and liquid.clm. and promoted	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:50
S115	75	remov$4 with mercury and (br or bromine) with liquid with carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:54
S116	0	separating greater than "70" wt% of the mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S117	0	((separating greater) with (of the mercury)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
S118	20	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:43

S119	40	(during with after with mercury with sorbent)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:38
S120	304	sorbent with mercury and sorbent with boiler	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:39
S121	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:41
S122	18	before with burn$4 with coal with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/01 17:42
S123	204	("0174348" | "0202092" | "0208011" | "0224649" | "0229159" | "0298727" | "0346765" | "0347078" | "0367014" | "0537926" | "0537998" | "0541025" | "0625754" | "0647622" | "0685719" | "0688782" | "0700888" | "0744908" | "0846338" | "0894110" | "0896876" | "0911960" | "0945331" | "0945846" | "1112547" | "1167471" | "1167472" | "1183445" | "1788466" | "1984164" | "20020065581" | "20020114749" | "20020184817" | "20030088370" | "20030103882" | "20040003716" | "20040013589" | "20040086439" | "20040219083" | "20050039598" | "20060047526" | "20060210463" | "2016821" | "2059388" | "2089599" | "2511288" | "3194629" | "3288576" | "3437476" | "3599610" | "3662523" | "3725530" | "3764496" | "3823676" | "3838190" | "3849267" | "3849537" | "3956458" | "3961020" | "3974254" | "4040802" | "4075282" | "4094777" | "4101631" | "4115518" | "4148613" | "4174373" | "4196173" | "4226601" | "4233274" | "4272250" | "4280817" | "4305726" | "4322218" | "4377599" | "4387653" | "4394354" | "4440100" | "4472278" | "4474896" | "4519807" | "4519995" | "4555392" | "4582936" | "4602918" | "4629721" | "4693731" | "4716137" | "4741278" | "4758418" | "4764219" | "4786483" | "4804521" | "4807542" | "4824441" | "4830829" | "4873930" | "4886519" | "4892567" | "4915818" | "4933158" | "4936047" | "4964889" | "5013358" | "5024171" | "5049163" | "5116793" | "5126300" | "5137854" | "5162598" | "5190566" | "5238488" | "5350728" | "5368617" | "5409522" | "5435980" | "5447703" | "5460643" | "5505746" | "5505766" | "5571490").PN. OR ("5587003" |	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/01 17:42

		"5618508" | "5635150" | "5659100" | "5670122" | "5733516" | "5738834" | "5787823" | "5810910" | "5897688" | "5910292" | "5989506" | "6024931" | "6083289" | "6240859" | "6258334" | "6372187" | "6375909" | "6475451" | "6521021" | "6528030" | "6533842" | "6558454" | "6610263" | "6613110" | "6719828" | "6732055" | "6737031" | "6746531" | "6790420" | "6808692" | "6848374" | "6878358" | "6942840" | "6953494" | "6962617" | "6974564" | "6975975" | "7468170" | "7507083" | "7674442" | "7758827" | "7776301").PN.				
S124	1	"15573128"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:07
S125	2	"20110207597"	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/10/02 12:08
S126	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S127	71	sorbent with before with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:30
S128	234	"6953494"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:38
S129	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 17:40
S130	35	promoter with sorbent and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S131	28	promoter with sorbent with mercury and "30" g	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:19
S132	4	promoter with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:20
S133	4	promot$4 with sorbent with mercury and ("30" g).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:23

S134	4	promot$4 with sorbent with mercury and pre.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:41
S135	2	promot$4 with sorbent with mercury and pre-heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/02 22:42
S136	2	promot$4 with sorbent with mercury and pre heater	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S137	57	promot$4 with sorbent with mercury and pre	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:36
S138	24	sorbent with preheat$4 with coal	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:39
S139	121	"5435980"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 08:47
S140	23	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:28
S141	5	"14102896"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 11:48
S142	7	"12429058"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:09
S143	4	"12202595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:23
S144	20	"12201595"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:24
S145	3	"14564860"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:27

S146	1	"15978760"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:28
S147	1	"15589359"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:32
S148	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:37
S149	8	"15997091"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S150	6	"14712558"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 12:42
S151	2	"15951970"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:18
S152	4	"15382114"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:47
S153	1	"15853029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 15:51
S154	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:18
S155	69	"4279873"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/03 18:42
S156	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 07:59
S157	4	"15295594"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 08:08

S158	1	("20180257030").PN.	US-PGPUB; USPAT	ADJ	ON	2018/10/04 09:31
S159	86	"5569436"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:32
S160	6	"5785935"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S161	8	"6475471"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 09:33
S162	53	"6103205"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:46
S163	0	pyrolysis with char with mercury with activated	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S164	17	pyrolysis with char with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:49
S165	121	pyrolysis with char with activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S166	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S167	43	pyrolysis with char with activated carbon and mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 11:50
S168	118	pyrolysis with char with tire	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S169	58	pyrolysis with char with activated carbon and mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 12:04
S170	8	"20040081724"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2018/10/04 15:07

			FPRS; EPO; JPO			
S171	4	"14128179"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 15:10
S172	84	activat$4 carbon with boiler with coal and remov$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S173	88	activat$4 carbon with boiler with coal and (remov$4 or filter$4 or absorb$4 or adsorb$4) with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 13:27
S174	0	mercury with stabiliz$4 with sulfer dioxide	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 14:23
S175	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 15:07
S176	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:48
S177	17	"8821819"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:51
S178	15	"8652235"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:55
S179	93	"6136749"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/24 09:08
S180	4	"9757689"	US-PGPUB; USPAT	ADJ	ON	2018/10/24 12:37

10/ 24/ 2018 2:38:50 PM
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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Unknown
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20090297413A1	12/3/2009	Olson, Edwin S, et al.
	US-20180133646A1	5/17/2018	Pavlish, John H, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 14/712,558, Non Final Office Action mailed 07-02-18", 16 pgs	
	"Application Serial No. 14/712,558, Supplemental Amendment filed 06-13-2018", 14 pgs.	
	"Application Serial No. 15//978,760, Preliminary Amendment Filed 5-15-2018", 7 pgs.	
	"Application Serial No. 15/295,594, Response filed 07-03-18 to Restriction Requirement mailed 05-22-18", 9 pgs.	
	"Application Serial No. 15/295,594, Response filed 07-24-18 to Restriction Requirement mailed 06-29-18", 9 pgs.	
	"Application Serial No. 15/295,594, Restriction Requirement mailed 05-22-18", 6 pgs	
	"Application Serial No. 15/295,594, Restriction Requirement mailed 06-29-18", 5 pgs	
	"Application Serial No. 15/295,594, Supplemental Amendment Filed 5-15-2018", 10 pgs.	
	"Application Serial No. 15/449,112, Notice of Allowance mailed 07-12-18", 8 pgs	
	"Application Serial No. 15/589,359, Final Office Action mailed 06-04-18", 13 pgs	
	"Application Serial No. 15/589,359, Response filed 05-18-18 to Non Final Office Action mailed 02-21-18", 14 pgs.	
	"Application Serial No. 15/589,359, Response filed 07-26-18 to Non Final Office Action mailed 06-04-18", 14 pgs.	
	"Application Serial No. 15/978,760 , Response filed 07-13-18 to Non Final Office Action mailed 06-29-18", 12 pgs	
	"Application Serial No. 15/978,760, Non Final Office Action mailed 06-29-18", 9 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 07-27-18", 13 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 04-24-18", 4 pgs	
	"Supplementary European Search Report, dated December 6, 2012", 2 pgs	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 10/24/2018

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9

CONFIRMATION NO. 1072

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

PUBLICATION NOTICE

OC000000102290773

Title:SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Publication No.US-2018-0257030-A1
Publication Date:09/13/2018

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.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/974,343 Group Art Unit: 1776
Filed: May 8, 2018 Docket No.: 4820.001US9
Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.111

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

Applicant has received the Non-Final Office Action dated July 27, 2018. Please enter the following.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.:	4820.001US9	Serial No.:	15/974,343
Filed:	May 8, 2018	Due Date:	October 27, 2018
Examiner:	Unknown	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	1072

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Amendment and Response under 37 C.F.R. § 1.111 (11 pgs.)
X Supplemental Information Disclosure Statement (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (17).
X Authorization to charge Deposit Account 19-0743 in the amount of $240.00 to cover the fee for consideration of Information Disclosure Statement under 37 C.F.R. § 1.97(c).

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

Electronic Patent Application Fee Transmittal

Application Number:	15974343
Filing Date:	08-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Steven M. Reid/Megan Reed
Attorney Docket Number:	4820.001US9

Filed as Large 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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	33466777
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Steven M. Reid/Megan Reed
Filer Authorized By:	Steven M. Reid
Attorney Docket Number:	4820.001US9
Receipt Date:	14-AUG-2018
Filing Date:	08-MAY-2018
Time Stamp:	17:11:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	081518INTEFSW00004197190743
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIGNED_4820_001US9_NFOA_SIDS.pdf	229895 002c238b3fb4970c7143e5c6fc5e3ec766fac15e	yes	15

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Form (SB08)	15	15
	Transmittal Letter	13	14
	Applicant Arguments/Remarks Made in an Amendment	6	12
	Claims	3	5
	Amendment/Req. Reconsideration-After Non-Final Reject	2	2
	Transmittal Letter	1	1

Warnings:					
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2	Non Patent Literature	4820001U10_OARN_PE_07272018.pdf	1583458 599daa9709712268953 6bf035f5273df8113f8fe	no	13
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6	Non Patent Literature	4820003US2_FOAR_06042018.pdf	448582 5e3e919f99d15c3515b0f22cae8c575bb29df28c	no	13
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7	Non Patent Literature	4820005US1_NOAR_07122018.pdf	1380205 2a970f7be1c4de7fd99c680c5ea1890b9cf727de	no	8
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9	Non Patent Literature	4820007US3_RERR_06292018.pdf	732397 8c931e7e91267ac6979c587e6faabf43213b710a	no	5
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10	Non Patent Literature	4820007US3_RRR1MO_072418.pdf	116107 d5f9c0f300d0d5effb5f15902c28fb1a4eeb1316	no	9
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15	Non Patent Literature	15978760_pamd.pdf	113109 884892d715ca83c0efb48bd8a923ce0388435ded	no	7
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Information:					
16	Non Patent Literature	Supp_EU_Search_Rpt_12_6_2012.pdf	71429 6be4fb2af74048d89e93afe9c44dd589a5f6bf96	no	2
Warnings:					
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Information:					

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Warnings:	
Information:	
Total Files Size (in bytes):	9517607

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: AMBER ROSE ORLANDO
Application No.: 15/974,343 Group Art Unit: 1776
Filed: May 8, 2018 Docket No.: 4820.001US9
Confirmation No.: 1072
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.111

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
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Customer No.: 21186

By: /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

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First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Steven M. Reid/Megan Reed
Attorney Docket Number:	4820.001US9

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International Application Number:	
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First Named Inventor/Applicant Name:	Edwin S. Olson
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Multipart Description/PDF files in .zip description

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Transmittal Letter	1	1

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Warnings:

Information:

3	Non Patent Literature	4820001US7_Amend_20180613.pdf	147570 610b07480e7cd58352c4e20a1ff92328d8f5a355	no	14

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Information:					

19	Fee Worksheet (SB06)	fee-info.pdf	30344 af34564b4515b39fa11b9f52d70e5ccd7bcc9f5a	no	2

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Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Unknown
Sheet 1 of 1	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20090297413A1	12/3/2009	Olson, Edwin S, et al.
	US-20180133646A1	5/17/2018	Pavlish, John H, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 14/712,558, Non Final Office Action mailed 07-02-18", 16 pgs	
	"Application Serial No. 14/712,558, Supplemental Amendment filed 06-13-2018", 14 pgs.	
	"Application Serial No. 15//978,760, Preliminary Amendment Filed 5-15-2018", 7 pgs.	
	"Application Serial No. 15/295,594, Response filed 07-03-18 to Restriction Requirement mailed 05-22-18", 9 pgs.	
	"Application Serial No. 15/295,594, Response filed 07-24-18 to Restriction Requirement mailed 06-29-18", 9 pgs.	
	"Application Serial No. 15/295,594, Restriction Requirement mailed 05-22-18", 6 pgs	
	"Application Serial No. 15/295,594, Restriction Requirement mailed 06-29-18", 5 pgs	
	"Application Serial No. 15/295,594, Supplemental Amendment Filed 5-15-2018", 10 pgs.	
	"Application Serial No. 15/449,112, Notice of Allowance mailed 07-12-18", 8 pgs	
	"Application Serial No. 15/589,359, Final Office Action mailed 06-04-18", 13 pgs	
	"Application Serial No. 15/589,359, Response filed 05-18-18 to Non Final Office Action mailed 02-21-18", 14 pgs.	
	"Application Serial No. 15/589,359, Response filed 07-26-18 to Non Final Office Action mailed 06-04-18", 14 pgs.	
	"Application Serial No. 15/978,760 , Response filed 07-13-18 to Non Final Office Action mailed 06-29-18", 12 pgs	
	"Application Serial No. 15/978,760, Non Final Office Action mailed 06-29-18", 9 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 07-27-18", 13 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 04-24-18", 4 pgs	
	"Supplementary European Search Report, dated December 6, 2012", 2 pgs	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Unknown
Serial No.: 15/974,343	Group Art Unit: 1776
Filed: May 8, 2018	Docket: 4820.001US9
Customer No.: 21186	Confirmation No.: 1072

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(c)(2), Applicant hereby authorizes the Commissioner to charge the fee of $240.00 as set forth in 37 C.F.R. § 1.17(p), to Deposit Account No. 19-0743. Please charge any additional fees or deficiencies, or credit any overpayment to Deposit Account No. 19-0743.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9580

Date August 14, 2018 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:mlr1

REMARKS

This responds to the Non-Final Office Action dated July 27, 2018.

No claims are presently amended. No claims are presently canceled, and claims 11-13 and 15-20 were canceled previously. No new claims are presently added. As a result, claims 1-10, 14, and 21-25 are now pending in this application.

The Rejection of Claims Under §103

I. The Office Action rejected claims 1-2, 5-8, 14, and 21-24 under 35 U.S.C. § 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. patent publication no. 2007/0168213 ("Comrie").

This rejection is respectfully traversed.

Independent claim 1 recites "…combusting a mixture of coal and an additive that has been added to the coal, the additive comprising a bromide compound, to form the mercury-containing gas…."

The Office Action states at page 3 that Nelson "…does not disclose combusting the coal in the presence of an additive that has been added to the coal, the additive comprising a bromide compound." The Office Action alleges that one of ordinary skill in the art would use Comrie to derive this feature and would combine it with Nelson to obtain the presently claimed invention. Applicant respectfully disagrees. As explained herein at **I(A)**, Comrie is not prior art. As explained herein at **I(B)**, Nelson cannot be used to achieve the presently claimed invention. As explained herein at **I(C)**, the presently claimed invention has advantages that could not be predicted by a person of ordinary skill in the art before the invention was made. Further, as explained herein at **I(D)**, the next Office Action cannot be properly made final.

I(A). Comrie is not prior art.

Comrie was published July 19, 2007, and the earliest priority is to a provisional application filed January 19, 2006. In contrast, the present application is a continuation that derives priority from a provisional application filed August 30, 2004 and converted to a U.S. Utility application on August 22, 2005. The present application has priority that is one year and five months prior to Comrie's earliest priority date; even if only the first U.S. Utility application is considered for

support, Comrie's earliest priority date is still about five months later. Comrie is not prior art and could not be considered by a person of ordinary skill in the art prior to the time the present invention was made and the present application filed.

I(B). Nelson cannot be used achieve the presently claimed invention.

Nelson mentions promoting activated carbon outside of flue gas, and then adding the activated carbon to flue gas.

No cited reference that is available as prior art to the present application describes or suggests combusting coal in the presence of an additive that includes a bromide compound. Therefore, independent claim 1 is patentable.

I(C). The presently claimed invention has advantages that could not be predicted by a person of ordinary skill in the art before the invention was made.

The inventors of the present application have discovered that by combusting coal in the presence of a bromide compound, and by placing a sorbent in the mercury-containing gas, as presently claimed, the sorbent can be bromide-promoted in-flight in the mercury-containing gas. Promotion of the sorbent in the mercury-containing gas has certain advantages that would be impossible for a person of ordinary skill in the art hypothetically having the cited prior art references in-hand.

Applicant's continuation-in-part U.S. application no. 15/853,029, published as U.S. patent publication no. 2018/0133646, includes experimental data in Part II of the Examples that compares the performance of activated sorbents added to the flue gas and promoted in-flight in the mercury-containing gas by bromide promoters that are added to the combustor to the performance of activated sorbents that are promoted outside of the flue gas and then added to the flue gas. As shown in Table 1 and as explained in paragraphs [0116]-[0117], promotion of the activated carbon in-flight in the mercury containing gas yielded significantly improved mercury capture compared to the activated carbon that was promoted before adding to the mercury-containing gas.

The M.P.E.P. at the beginning of § 2143.02 states (emphasis added) "[a] rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known

methods with no change in their respective functions, *and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art.*" The only cited reference available as prior art is Nelson; there is no way to predict from Nelson the superior mercury capture discovered by the present inventors that occurs when activated carbon is promoted in-flight in the mercury-containing gas, as occurs when following the present claims. The presently claimed invention therefore has advantages that could not be predicted from the cited references by a person of ordinary skill in the art before the invention was made; accordingly, independent claim 1 is patentable over the cited references.

Dependent claims 2, 5-8, 14, and 21-24 are dependent on independent claim 1. As such, these claims incorporate all the features of claim 1. Accordingly, claims 2, 5-8, 14, and 21-24 are patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 1-2, 5-8, 14, and 21-24 under 35 U.S.C. § 103(a) over Nelson in view of Comrie.

I(D). The next Office Action cannot be made final.

As explained herein at **I(A)-I(C)**, the present claims are patentable over the cited references. Applicant has not amended the claims and, as such, has not introduced any new features or limitations which would suffice under MPEP §706.07(a) to render any subsequent action on the merits final. If the PTO wishes to issue a further action in response to the remarks presented herein, Applicant respectfully submits that such action should be non-final.

II. The Office Action rejected claim 4 under 35 U.S.C. § 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. patent publication no. 2007/0168213 ("Comrie") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed.

As explained herein at **I(A)-(C)**, independent claim 1 is patentable over Nelson and Comrie. Srinivasachar fails to remedy the deficiencies of Nelson and Comrie; therefore, claim 1 is patentable over this combination of references.

Dependent claim 4 is indirectly dependent on independent claim 1. As such, this claim incorporates all the features of claim 1. Accordingly, claim 4 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 4 under 35 U.S.C. § 103(a) over Nelson in view of Comrie and Srinivasachar.

III. The Office Action rejected claim 9 under 35 U.S.C. 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. patent publication no. 2007/0168213 ("Comrie") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed.

As explained herein at **I(A)-(C)**, independent claim 1 is patentable over Nelson and Comrie. Srinivasachar fails to remedy the deficiencies of Nelson and Comrie; therefore, claim 1 is patentable over this combination of references.

Claim 9 is dependent on independent claim 1. As such, this claim incorporates all the features of claim 1. Accordingly, claim 9 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 9 under Nelson in view of Comrie and Srinivasachar.

IV. The Office Action rejected claim 10 under 35 U.S.C. § 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. patent publication no. 2007/0168213 ("Comrie"), and U.S. patent no. 6,136,749 ("Gadkaree").

The document U.S. patent no. 6,848,374 ("Srinivasachar") was discussed and applied in the rejection but was not included in the formal statement of the rejection.

This rejection is respectfully traversed.

As explained herein at **I(A)-(C)**, independent claim 1 is patentable over Nelson and Comrie. Gadkaree and Srinivasachar fail to remedy the deficiencies of Nelson and Comrie; therefore, claim 1 is patentable over this combination of references.

Claim 10 is dependent on independent claim 1. As such, this claim incorporates all the features of claim 1. Accordingly, claim 10 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 10 under 35 U.S.C. § 103(a) over Nelson in view of Comrie, Gadkaree, and Srinivasachar.

V. The Office Action rejected claim 25 under 35 U.S.C. § 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. patent publication no. 2007/0168213 ("Comrie") and U.S. patent no. 6,878,358 ("Vosteen").

This rejection is respectfully traversed.

As explained herein at **I(A)-(C)**, independent claim 1 is patentable over Nelson and Comrie. Vosteen fails to remedy the deficiencies of Nelson and Comrie; therefore, claim 1 is patentable over this combination of references.

Claim 25 is dependent on independent claim 1. As such, this claim incorporates all the features of claim 1. Accordingly, claim 25 is patentable for at least the reasons given herein for patentability of independent claim 1.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 25 under 35 U.S.C. § 103(a) over Nelson in view of Comrie and Vosteen.

Double Patenting Rejection

VI. The Office Action rejected claims 1-2, 5-10, and 21-25 for nonstatutory double patenting over claims 1, 3, 12, 13, 22 and 26 of U.S. patent no. 7,435,286 ('286) in view of U.S. patent publication no. 2007/0168213 ("Comrie").

This rejection is respectfully traversed. Applicant does not admit that claims 1-2, 5-10, and 21-25 are obvious in view of claims 1, 3, 12, 13, 22 and 26 of the '286 in view of Comrie.

In the rejection, the Office Action derives the feature of combusting coal in the presence of an additive that includes a bromide compound from Comrie. However, as explained herein at **I(A)**, Comrie is not available as prior art to the present application.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 1-2, 5-10, and 21-25 for nonstatutory double patenting over claims 1, 3, 12, 13, 22 and 26 of the '286 in view of Comrie.

VII. The Office Action rejected claims 3 and 4 for nonstatutory double patenting over claim 1 of U.S. patent no. 7,435,286 ('286) in view of U.S. patent publication no. 2007/0168213 ("Comrie") and U.S. patent no. 6,848,374 ("Srinivasachar").

This rejection is respectfully traversed. Applicant does not admit that claims 3 and 4 are obvious in view of claim 1 of the '286 in view of Comrie and Srinivasachar.

In the rejection, the Office Action derives the feature of combusting coal in the presence of an additive that includes a bromide compound from Comrie. However, as explained herein at **I(A)**, Comrie is not available as prior art to the present application.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 3 and 4 for nonstatutory double patenting over claim 1 of the '286 in view of Comrie and Srinivasachar.

CONCLUSION

It is respectfully submitted that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone the undersigned at (612) 349-9580 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402-0938
(612) 373-6900

Date August 14, 2018

By /Nicholas P. Lanzatella/

Nicholas P. Lanzatella
Reg. No. 63,803

IN THE CLAIMS

Please amend the claims as follows:

1. (Previously Presented) A method for separating mercury from a mercury-containing gas, the method comprising:

combusting a mixture of coal and an additive that has been added to the coal, the additive comprising a bromide compound, to form the mercury-containing gas;

adding a particulate sorbent material comprising activated carbon into the mercury-containing gas;

promoting at least a portion of the sorbent material by chemically reacting the sorbent material with Br_2, HBr, Br^-, or a combination thereof, in-flight, to form a promoted sorbent material;

chemically reacting mercury in the mercury-containing gas with the promoted sorbent material, to form a mercury-sorbent; and

separating the mercury-sorbent from the mercury-containing gas.

2. (Original) The method of claim 1, further comprising mixing the additive and the coal before combusting the coal.

3. (Original) The method of claim 2, wherein the additive mixed with the coal is in a liquid.

4. (Original) The method of claim 3, wherein the liquid is a hydrocarbon, a chlorinated hydrocarbon, supercritical carbon dioxide, water, salt solution, or a combination thereof.

5. (Original) The method of claim 1, wherein the promoted sorbent material comprises active sites, wherein the active sites comprise halide anions bound to the activated carbon.

6. (Original) The method of claim 1, wherein the promoted sorbent material comprises active sites, wherein the active sites comprise carbocations bound to halide anions.

7. (Original) The method of claim 1, wherein chemically reacting the sorbent material with the additive in the mercury-containing gas comprises chemically reacting carbene species edge sites in the activated carbon with the additive.

8. (Original) The method of claim 1, wherein carbocations in the activated carbon of the mercury-sorbent accept electrons from mercury atoms of the mercury-sorbent.

9. (Original) The method of claim 1, wherein the additive is substantially in vapor form in the mercury-containing gas.

10. (Previously Presented) The method of claim 1, wherein the additive comprises Ca, Na, or a combination thereof.

11.-13. (Canceled)

14. (Original) The method of claim 1, wherein the activated carbon is chosen from powdered activated carbon, granular activated carbon, carbon black, carbon fiber, aerogel carbon, pyrolysis char, and combinations thereof.

15.-20. (Canceled)

21. (Previously Presented) The method of claim 1, wherein the coal and the additive are mixed at a location upstream of a combustion furnace where combustion occurs.

22. (Previously Presented) The method of claim 1, comprising separating greater than 70 wt% of the mercury from the mercury-containing gas.

23. (Previously Presented) The method of claim 1, comprising separating greater than 70 wt% of the mercury from the mercury-containing gas on the sorbent.

24. (Previously Presented) The method of claim 1, wherein the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon.

25. (Previously Presented) The method of claim 1, wherein the method is a method for reducing mercury in the mercury-containing gas to a desired level, wherein separating the mercury-sorbent from the mercury-containing gas forms a cleaned gas, the method further comprising:

monitoring the mercury content of the cleaned gas; and

controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below the desired level.

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
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/974,343	Filing Date 05/08/2018	☐ To be Mailed

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), (l), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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	08/14/2018	(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))	* 16	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	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 $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	brenda murphy
*** 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.	

This collection of information is required by 37 CFR 1.16. 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, 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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 07/27/2018

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
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UNITED STATES OF AMERICA

EXAMINER	
ORLANDO, AMBER ROSE	

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
07/27/2018	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

Office Action Summary	Application No. 15/974,343	Applicant(s) Olson et al.	
	Examiner AMBER R ORLANDO	Art Unit 1776	AIA 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 05/08/2018.

☐ 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) 1-10,14 and 21-25 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) 1-10,14 and 21-25 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 05/08/2018 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: _____.

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 following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and

invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

Claim 1, 2, 5-8, 14 and 21-24 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nelson Jr. US 2004/00033716 in view of Comrie US 2007/0168213.

For claims 1 and 2, the Nelson Jr. reference discloses a method for separating mercury from a mercury-containing gas, the method comprising: combusting a mixture of coal, to form the mercury-containing gas (paragraphs [0059] and [0060]), adding a particulate sorbent material comprising activated carbon into the mercury-containing gas; promoting at least a portion of the sorbent material by chemically reacting the sorbent material with Br_2, HBr, Br^- or a combination thereof, in-flight, to form a promoted sorbent material (paragraphs [0044], [0044], [0059] and [0060]); chemically reacting mercury in the mercury-containing gas with the promoted sorbent material, to form a mercury-sorbent; and separating the mercury-sorbent from the mercury-containing gas (paragraph [0060]). The reference does not disclose combusting the coal in the presence of an additive that has been added to the coal, the additive comprising a bromide compound.

The Comrie reference discloses that the sorbent compositions can be added anywhere within the coal burning process, before, during or after (paragraph [0006]).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Nelson reference to include either rearranging steps, or repeat steps to have the combusting coal in the presence of the additive and activated carbon and comprising mixing the additive and the coal before combusting the coal so as to entrap the contaminants in the mercury containing gas rather than release them to the atmosphere (Comrie paragraph [0006]). Further the courts have held that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230.

For claim 3 Nelson reference further discloses that the mercury sorbents can be injected in a liquid slurry (paragraph [0064]).

With the combination of Comrie above, this would result in "the additive mixed with the coal is in a liquid" limitation of claim 3.

For claims 5 and 6, the promoted sorbent as disclosed by Nelson above would include active sites, wherein the active sites comprise halide anions bound to the activated carbon and active sites, wherein the active sites comprise carbocations bound to halide anions.

For claims 7 and 8, the sorbent being promoted is disclosed by Nelson above and would inherently chemically react the sorbent material with the additive in the mercury-containing gas comprises chemically reacting carbene species edge sites in the activated carbon with the additive as well as carbocations in the activated carbon of the mercury-sorbent accept electrons from mercury atoms of the mercury-sorbent. Each of the steps of the process are shown above. Therefore the result of performing those steps as shown by Nelson would inherently be the same, i.e. chemically reacting the sorbent material with the additive in the mercury-containing gas comprises chemically reacting carbene species edge sites in the activated carbon with the additive and carbocations in the activated carbon of the mercury-sorbent accept electrons from mercury atoms of the mercury-sorbent.

For claim 14, the Nelson reference discloses the activated carbon is chosen from powdered activated carbon, granular activated carbon, carbon black, carbon fiber, aerogel carbon, pyrolysis char, and combinations thereof (paragraph [0040]).

For claim 21, the Nelson reference does not disclose the coal and the additive are mixed at a location upstream of a combustion furnace where combustion occurs.

The Comrie reference discloses that the sorbent compositions (i.e. additives) can be added anywhere within the coal burning process, before, during or after (paragraph [0006]). This would include

the coal and the additive are mixed at a location upstream of a combustion furnace where combustion occurs.

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Nelson reference to include either rearranging steps, or repeat steps to have the combusting coal in the presence of the additive and activated carbon and comprising the coal and the additive are mixed at a location upstream of a combustion furnace where combustion occurs so as to entrap the contaminants in the mercury containing gas rather than release them to the atmosphere (Comrie paragraph [0006]). Further the courts have held that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230.

For claim 22, the limitations are the result of the method. As the method is disclosed by Nelson and Comire as shown above, the result of such a combination would also occur, i.e. separating greater than 70 wt% of the mercury from the mercury-containing gas. Further the Nelson reference discloses 90% mercury removal (paragraph [0084]).

For claim 23 the limitations are the result of the method. As the method is disclosed by Nelson and Comire as shown above, the result of such a combination would also occur, i.e. separating greater than 70 wt% of the mercury from the mercury-containing gas on the sorbent. Further the Nelson reference discloses 90% mercury removal (paragraph [0084]).

For claim 24, the Nelson reference does not explicitly state the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the sorbent material has a composition comprising from about 1 to about 30 grams of additive per 100 grams of activated carbon, since it has been held that where the general conditions of a

claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

Claim 4 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nelson Jr. US 2004/00033716 and Comrie US 2007/0168213 as applied in claim 1 above, and further in view of Srinivasachar et al. US 6,848,374.

For claim 4, the Nelson reference does not disclose the liquid is a hydrocarbon, a chlorinated hydrocarbon, supercritical carbon dioxide water, salt solution or a combination thereof.

The Srinivasachar et al. reference discloses that the promoter can be deposited on the carbon sorbent in many different ways including in solution as well as gaseous (column 6, lines 7-16).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Nelson reference to include the promoter can be deposited on the carbon sorbent in solution i.e. salt solution and water (Srinivasachar et al. column 6, lines 7-13) as these methods of deposition on the carbon are art recognized equivalents and so as to allow for the condensing/absorbing of the halogen on the sorbent.

Claim 4 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nelson Jr. US 2004/00033716 and Comrie US 2007/0168213 as applied in claim 3 above, and further in view of Srinivasachar et al. US 6,848,374.

For claim 9, the Nelson reference does not disclose the additive is substantially in vapor form in the mercury-containing gas.

The Srinivasachar et al. reference discloses the additive is substantially in vapor form in the mercury-containing gas (column 8, lines 13-21).

It would have been obvious to one having ordinary skill in the art to have modified the Nelson reference to include the additive is substantially in vapor form in the mercury-containing gas

(Srinivasachar et al. column 8, lines 13-21) so as to allow for the condensing/absorbing of the halogen on the sorbent.

Claim 10 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nelson Jr. US 2004/00033716 and Comrie US 2007/0168213 as applied in claim 1 above and further in view of Gadkaree US 6,136,749.

For claim 10, the Nelson reference does not disclose the additive comprises Ca, Na. or a combination thereof.

The Nelson reference does not disclose the additive comprises Ca, Na. or a combination thereof.

The Gadkaree reference discloses o-injecting an alkaline component into the mercury containing flue gas stream (Gadkaree column 3, lines 54-65). The Srinivasachar reference discloses the alkaline component is selection from the group consisting of alkali elements and alkaline earth elements (Srinivasachar column 6, lines 2-20).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Nelson reference to include co-injecting and alkaline component into the mercury containing flue gas stream, the alkaline component being selected from the group consisting of alkali elements and alkaline earth elements (as shown by Gadkaree and Srinvasachar above) so as to enhance the activity of the activated carbon catalyst.

Claim 25 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Nelson Jr. US 2004/00033716 and Comrie US 2007/0168213 as applied in claim 1 above and further in view of Vosteen et al. US 6,878,358.

For claim 25, the Nelson reference discloses the method is a method for reducing mercury in the mercury-containing gas to a desired level, wherein separating the mercury-sorbent from the mercury-containing gas forms a cleaned gas (paragraph [0060]). The Nelson reference does not disclose monitoring the mercury content of the cleaned gas; and controlling, in response to the monitored

mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below the desired level.

The Vosteen reference discloses monitoring the mercury content of the cleaned gas; and controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below the desired level (column 5, lines 47-63).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the Nelson reference to include monitoring the mercury content of the cleaned gas; and controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below the desired level (Vosteen column 5, lines 47-63) so as to allow for the maxiumum amount of mercury to be removed from the waste gas stream.

Double Patenting

Claims 1-2 and 5-10, and 21-25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 3, 12, 13, 22 and 26 of U.S. Patent No. 7,435,286 ('286) in view of Comrie US 2007/0168213.

Claims 1, 2 and 21 of the current application corresponds to claim 1 of '286 except for combusting the coal in the presence of an additive that has been added to the coal, the additive comprising a bromide compound.

The Comrie reference discloses that the sorbent compositions can be added anywhere within the coal burning process, before, during or after (paragraph [0006]).

Claims 5-8 of the current application correspond to claim 1 of '286 for the same reasons as stated in the rejection above.

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the '286 reference to include either rearranging steps, or repeat steps to have the combusting coal in the presence of the additive and activated carbon and comprising mixing the additive and the coal before combusting the coal so as to entrap the contaminants in the mercury containing gas rather than release them to the atmosphere (Comrie paragraph [0006]). Further the courts have held that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230.

Claim 9 of the current application corresponds to claim claims 1, 12 and 13 of '286.

Claim 3 of the current application corresponds to claim claims 1 and 3 of '286.

Claims 22 and 23 of the current application corresponds to claim claims 1 of '286.

Claim 24 of the current application corresponds to claim claims 1 and 26 of '286.

Claim 25 of the current application corresponds to claim claims 1, and 22 of '286.

Claims 3 and 4 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 of U.S. Patent No. 7,435,286 ('286) in view of Comrie US 2007/0168213 and Srinivasachar et al. US 6,848,374.

Claims 3 and 4 of the current application corresponds to claim 1 of '286 except for the additive mixed with the coal is in a liquid and the liquid is a hydrocarbon, a chlorinated hydrocarbon, supercritical carbon dioxide, water, salt solution, or a combination thereof.

The Srinivasachar et al. reference discloses that the promoter can be deposited on the carbon sorbent in many different ways including in solution as well as gaseous (column 6, lines 7-16).

It would have been obvious to one having ordinary skill in the art before the invention was made to have modified the '286 reference to include the promoter can be deposited on the carbon sorbent in

solution i.e. salt solution and water (Srinivasachar et al. column 6, lines 7-13) as these methods of deposition on the carbon are art recognized equivalents and so as to allow for the condensing/absorbing of the halogen on the sorbent.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMBER ROSE ORLANDO whose telephone number is (571)270-3149. The examiner can normally be reached on Monday-Thursday 7:00-5:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571)272-1166. 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.

AMBER ROSE. ORLANDO
Primary Examiner
Art Unit 1776

/AMBER R ORLANDO/
Primary Examiner, Art Unit 1776

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/974,343	Olson et al.
	Examiner	Art Unit
	AMBER R ORLANDO	1776

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text Search (SEE EAST SEARCH HISTORY)	07/23/2018	AO
IDS Search (EAST and DAV)	07/23/2018	AO
Inventor Search (EAST)	07/23/2018	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

S/N 15/974,343 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Edwin S. Olson et al.	Examiner:	Unknown
Serial No.:	15/974,343	Group Art Unit:	Unknown
Filed:	May 8, 2018	Docket:	4820.001US9
Customer No.:	21186	Confirmation No.:	1072
Title:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		

COMMUNICATION CONCERNING PRIOR OR COPENDING APPLICATION(S)

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

Pursuant to the guidance of MPEP §§ 2001.06(b) and 2004(9), Applicant would like to bring the following additional application(s) to the Examiner's attention. The identification of these applications is not intended to suggest that the subject matter claimed in any listed application is, or has been, substantially similar to any claim or claims in the present application.

Serial No./ Patent No.	Filing Date	Attorney Docket	Title
11/209,163 7,435,286	August 22, 2005	4820.001US1	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
12/201,595	August 29, 2008	4820.001US2	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
12/419,219 8,168,147	April 6, 2009	4820.001US3	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
13/427,665 8,512,655	March 22, 2012	4820.001US4	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
13/966,768 8,821,819	August 14, 2013	4820.001US5	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
14/318,270 9,757,689	June 27, 2014	4820.001US6	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
14/712,558	May 14, 2015	4820.001US7	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
15/951,970	April 12, 2018	4820.001US8	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

/AMBER R ORLANDO/ 07/23/2018

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

15/589,359	May 8, 2017	4820.003US2	ACTIVATED CARBON SORBENT INCLUDING NITROGEN AND METHODS OF USING THE SAME
14/195,360 9,669,355	March 3, 2014	4820.003US1	ACTIVATED CARBON SORBENT INCLUDING NITROGEN AND METHODS OF USING THE SAME
15/382,114	December 16, 2016	4820.004US1	PROMOTED AMMONIUM SALT-PROTECTED ACTIVATED CARBON SORBENT PARTICLES FOR REMOVAL OF MERCURY FROM GAS STREAMS
15/449,112	March 3, 2017	4820.005US1	SORBENT COMPRISING CARBON AND NITROGEN AND METHODS OF USING THE SAME
12/429,058 8,652,235	April 23, 2009	4820.007US1	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
14/102,896 9,468,886	December 11, 2013	4820.007US2	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
15/295,594	October 17, 2016	4820.007US3	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
15/978,760	May 14, 2018	4820.007US4	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
15/853,029	December 22, 2017	4820.018US1	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Respectfully submitted,

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.R.O/

Bibliographic Data

Application No: 15/974,343

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /AMBER R ORLANDO/ (Examiner's Signature) | (Initials)

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/08/2018	423	1776	4820.001US9
RULE			

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CONTINUING DATA

This application is a CON of 15951970 04/12/2018

15951970 is a CON of 14712558 05/14/2015

14712558 is a CON of 14318270 06/27/2014 PAT 9757689

14318270 is a CON of 13966768 08/14/2013 PAT 8821819

13966768 is a CON of 13427665 03/22/2012 PAT 8512655

13427665 is a CON of 12419219 04/06/2009 PAT 8168147

12419219 is a CON of 12201595 08/29/2008

12201595 is a CON of 11209163 08/22/2005 PAT 7435286

11209163 has PRO of 60605640 08/30/2004

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

06/05/2018

STATE OR COUNTRY

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UNITED STATES

FILING FEE RECEIVED

$5,860

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	separating greater than "70" wt% of the mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
L2	0	((separating greater) with (of the mercury)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:17
L3	20	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 09:43
S1	45	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S2	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorben and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:19
S3	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2013/09/09 09:20
S7	73	("20020150516" | "4786483" | "5409522" | "5505766" | "6383981" | "6878358" | "20020033097" | "4530765" | "5346674" | "6080281" | "4708853" | "6027551" | "6136072" | "6258334" | "6818043" | "20060057044" | "20080207443" | "20010002387" | "3826618" | "4814152" | "4820318" | "4889698" | "5891324" | "6528030" | "20050227146" | "5419834" | "7942566" | "20080134888" | "3662523" | "3849267" | "4196173" | "4500327" | "6942840" | "20020134242" | "20030136509" | "20050147549" | "20060112823" | "20080134888" | "6471936" | "20010003116" | "20050019240" | "20060048646" | "4956162" | "5575982" | "6372187" | "6375909" | "7435286" | "7514052" | "20050074380" | "20090081092" | "5288306" | "1984164" | "4101631" | "5695726" | "6080281" | "6848374" | "20050000197" | "5300137" | "5607496" | "5672323" | "6214304" | "6953494" | "5245120" | "20070168213" | "7938571" | "20040003716" | "20040013589" |	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:25

		"3194629" | "3786619" | "5827352" | "20040109800" | "20070295347" | "5435980" | "6136749" | "20030206846").PN.				
S8	13	"11209163"	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S9	3	"11209163" and non carbon	US-PGPUB; USPAT	ADJ	ON	2015/03/17 12:28
S10	161	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:49
S11	0	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and sorbent and promoter and activated carbond and mercury	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S12	116	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50
S13	172	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S14	67	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2015/08/20 22:04
S15	67	"6136749"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:11
S16	20	"684374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S17	1	"20040003716"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S18	68	"6848374"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:12
S19	41	"7435286"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S20	13	"8168147"	US-PGPUB; USPAT	ADJ	ON	2016/05/27 09:13
S21	69	(95/134.ccls. or 95/142.ccls. or 110/345.ccls. or 423/210.ccls.) and activated carbon and promoter	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S22	181	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/06/07 09:06
S25	28	"5266280"	US-PGPUB; USPAT	ADJ	ON	2016/06/07 13:41
S26	281	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 15:01
S27	148	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and	US-PGPUB; USPAT; USOCR;	ADJ	ON	2016/09/29 15:02

		halogen	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S28	159	sorbent with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:18
S29	206	(sorbent or activated carbon) with mercury and (diameter or size) with ("30" or "40" or "50" or "60" or "70") with (sorbent or carbon) and halogen$4 and activated carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/29 16:22
S30	195	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/09/30 13:48
S33	6	"20040003719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:56
S34	49	"2004003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:57
S35	81	"6848374"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 10:58
S36	56	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:02
S37	7	olson.in. and ("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:04
S38	0	("40" microns and halocarbon sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2016/11/16 11:05

			EPO; JPO; DERWENT; IBM_TDB			
S39	0	(halocarbon sorbent).clm. and "40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:05
S40	65	"40" microns and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S41	3907	("40" microns).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S42	29	("40" microns and sorbent).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:06
S43	1	(halocarbon sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S44	36	(sorbent).clm. and olson.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S45	0	(sorbent).clm. and olson.in. and "40" micron	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:08
S46	17	"11209163"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:09
S47	2	"20110233133"	US-PGPUB; USPAT;	ADJ	ON	2016/11/16 11:27

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S48	7	"20110023427"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:28
S49	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S50	11	"20040025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:32
S51	15	"2004025274"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S52	40	"6312489"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:33
S53	30	("20030024872" | "20050045553" | "20050144916" | "4008060" | "4640779" | "4655921" | "4673503" | "4738778" | "4746432" | "4799944" | "5043000" | "5051118" | "5120296" | "5174896" | "5320657" | "5512075" | "5674302" | "6152979" | "6312489" | "6315130" | "6336946" | "6398836" | "6585793" | "6598749" | "7648546").PN. OR ("7931723").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:36
S54	33	("4200444" | "4640779" | "5968215" | "6059851").PN. OR ("6312489").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:40
S55	5	"8518142"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:54
S56	4	"8747505"	US-PGPUB; USPAT; USOCR	ADJ	ON	2016/11/16 11:57
S57	2	"14318270"	US-PGPUB;	ADJ	ON	2016/11/16

			USPAT; USOCR			12:06
S58	13	pac with size with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 12:13
S59	197	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2016/11/16 15:23
S60	0	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent "4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S61	10	"4198388"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 12:39
S62	0	"2010083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S63	2	"20100083696"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:32
S64	2	absorp$5 with mea with methanol with acid	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:36
S65	2	"20070283813"	US-PGPUB; USPAT	ADJ	ON	2016/11/17 13:39
S66	21	"4469596"	US-PGPUB; USPAT	ADJ	ON	2016/11/21 08:29
S67	4	"2003229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S68	2	"20030229245"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:36
S69	45	"5,338,458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S70	45	"5338458"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/05/10 10:38
S71	213	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10,	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:02

		B01D53/10).cpc. and (halogen or halide of HBr) with sorbent				
S72	64	("1786483" | "1984164" | "2317857" | "20010002387" | "20010003116" | "20020134242" | "20020150516" | "20030136509" | "20040003716" | "20040013589" | "20050019240" | "20060048646" | "20060191835" | "20090062119" | "20100047146" | "20120183458" | "20140056787" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "4196173" | "4500327" | "4814152" | "4820318" | "4889698" | "4959162" | "5300137" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" | "5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "7101631" | "7435286" | "7479263" | "7514052" | "7563311" | "7611564" | "8007749" | "8168147" | "8168149" | "8512655").PN.	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:20
S73	3	("20090235848" | "20110076210" | "20150246315").PN.	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:31
S79	3	("20090235848" | "20110076210" | "20140224121").PN.	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:36
S80	96	("1984164" | "2317857" | "20010002387" | "20010003116" | "20020043496" | "20020134242" | "20020150516" | "20030104937" | "20030136509" | "20040003716" | "20040013589" | "20040076570" | "20050019240" | "20060048646" | "20060191835" | "20080182747" | "20080292512" | "20090062119" | "20090136401" | "20090320678" | "20100047146" | "20110168018" | "20120183458" | "20130280156" | "20140056787" | "20140255279" | "20140308188" | "20150098878" | "3194629" | "3662523" | "3786619" | "3826618" | "3849267" | "3876393" | "4094777" | "4101631" | "4196173" | "4338896" | "4500327" | "4708853" | "4786483" | "4814152" | "4820318" | "4889698" | "4956162" | "5300137" | "5336835" | "5409522" | "5462908" | "5505766" | "5575982" | "5607496" | "5672323" | "5695726" | "5827352" | "5891324" | "6027551" | "6080281" | "6136072" | "6136749" | "6214304" | "6258334" | "6372187" | "6375909" | "6383981" | "6471936" | "6528030" | "6638485" | "6808692" | "6818043" | "6848374" | "6878358" | "6942840" | "6953494" | "6960329" | "7081434" | "7211707" | "7435286" | "7479263" | "7514052" | "7521032" | "7544338" | "7563311" | "7611564" | "7622092" | "7722843" | "7767174" |	US-PGPUB; USPAT	ADJ	ON	2017/06/27 09:41

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S81	593	honeycomb with plug$4 and plug$4 with length	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S82	0	honeycomb with plug$4 and plug$4 with length with less than with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S83	0	honeycomb with plug$4 and plug$4 with length with less than	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:45
S84	127	honeycomb with plug$4 and plug$4 with length with "5"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:46
S85	241	honeycomb with plug$4 and plug$4 with length with mm	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:47
S86	41	honeycomb with plug$4 and plug$4 with length with "3 mm "	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:49
S87	28	honeycomb with plug$4 and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:52
S88	28	honeycomb and plug$4 with length with "3 mm " and plug$4 with porosity	US-PGPUB; USPAT	ADJ	ON	2017/06/27 14:53
S89	43	honeycomb and plug$4 with porosity with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:06
S90	20	honeycomb and plug$4 with pore (size or diameter) with "100"	US-PGPUB; USPAT	ADJ	ON	2017/06/27 15:07
S91	8	saw with honeycomb with filter	US-PGPUB; USPAT	ADJ	ON	2017/06/29 13:31
S92	230	(B01D53/64, B01D2257/602, B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	US-PGPUB; USPAT	ADJ	ON	2017/12/01 14:36
S93	2	"20060260468"	US-PGPUB; USPAT	ADJ	ON	2018/07/03 10:34
S94	19	engine with air with inlet with filter$4 with cone	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:26
S95	36	engine with air with inlet with filter$4 with (cone or conical or (diameter with (increas$4 or decreas$4)))	US-PGPUB; USPAT	ADJ	ON	2018/07/03 15:27
S96	24	("3771638" | "3870495" | "3872012" | "4157902" | "4702754" | "5125940" | "5522909" | "5549724" | "5632793").PN. OR ("5888260").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S97	41	("0153535" | "0439091" | "1398685" | "1530163" | "1887052" | "2087688" | "4003836" | "4018580" | "4032455" | "4039308" | "4065276" | "4261710" | "4410341" | "4414110" | "4699715" | "5106397" | "5178656" | "5522909" | "5549722" | "5549724" | "5888260" | "6397842" | "6508052" | "D401597" | "D401942" | "D403414" | "D403416").PN. OR ("6808552").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2018/07/03 15:31
S98	15	("D403416").URPN.	USPAT	ADJ	ON	2018/07/03 15:33
S99	0	"20030089233"	USPAT	ADJ	ON	2018/07/04 12:29
S100	3	"20030089233"	US-PGPUB;	ADJ	ON	2018/07/04

			USPAT; USOCR; FPRS; EPO; JPO			12:29
S101	26	"6833023"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/04 12:29
S102	2	"20070168213"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:08
S103	14	carbocations with sorbent with bromine	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:14
S104	0	a side forming a cross sectional shape of each of the first	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:47
S105	0	non of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S106	0	none of side forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S107	0	none of sides forming	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/09 13:56
S109	13	olson.in. and (alkali and promoter and earth).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S110	0	olson.in. and (alkali and promoter and earth with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S111	10	olson.in. and (alkali and promoter with vapor).clm.	US-PGPUB; USPAT	ADJ	ON	2018/07/17 16:22
S112	0	"2015008283"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S113	2	"20150082833"	US-PGPUB; USPAT	ADJ	ON	2018/07/23 06:26
S114	24	olson.in. and liquid.clm. and promoted	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:50
S115	75	remov$4 with mercury and (br or bromine) with liquid with carbon	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/07/23 07:54

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	15/974,343
Filing Date	May 8, 2018
First Named Inventor	Edwin S. Olson
Group Art Unit	Unknown
Examiner Name	Unknown

Sheet 1 of 19

Attorney Docket No: 4820.001US9

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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 2 of 19	Attorney Docket No: 4820.001US9	

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	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 3 of 19	Attorney Docket No: 4820.001US9	

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	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 4 of 19	Attorney Docket No: 4820.001US9	

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	Examiner Name	Unknown
Sheet 5 of 19	Attorney Docket No: 4820.001US9	

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Sheet 6 of 19	Attorney Docket No: 4820.001US9	

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	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 7 of 19	Attorney Docket No: 4820.001US9	

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	"Application Serial No. 14/318,270, Response filed 01-25-17 to Final Office Action mailed 11-25-16", 14 pgs	
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	"Application Serial No. 14/564,860, Response filed 05-06-16 to Restriction Requirement mailed 03-16-16", 9 pgs.	
	"Application Serial No. 14/564,860, Response filed 10-03-16 to Non Final Office Action mailed 07-12-16", 11 pgs	
	"Application Serial No. 14/564,860, Restriction Requirement mailed 03-16-16", 5 pgs	
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	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 11 of 19	Attorney Docket No: 4820.001US9	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS		
Examiner Initial *	**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, page(s), volume-issue number(s), publisher, city and/or country where published.**	**T1**
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	"Canadian Application Serial No. 2,584,327, Response filed 09-02-09 to Office Action mailed 03-03-09", 21 pgs	
	"Canadian Application Serial No. 2,707,363, First Examiners Report Received 6/16/11", 2 pgs	
	"Canadian Application Serial No. 2,757,309, Office Action mailed 12-07-15", 3 pgs	
	"Canadian Application Serial No. 2,757,309, Response filed 06-06-16 to Office Action mailed 12-07-15", 13 pgs	
	"Canadian Application Serial No. 2,757,309, Voluntary Amendment filed 01-30-15", 27 pgs	
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	"Canadian Application Serial No. 2,871,422, Office Action mailed 04-02-15", 5 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 08-31-17", 4 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 09-09-15", 3 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 12-22-16", 5 pgs	
	"Canadian Application Serial No. 2,871,422, Response filed 02-26-18 to Office Action mailed 08-31-17", w/ Amended Claims, 53 pgs	
	"Canadian Application Serial No. 2,871,422, Response filed 06-21-17 to Office Action mailed 12-22-16", 41 pgs	
	"Canadian Application Serial No. 2,871,422, Response filed 08-28-15 to Canadian Office Action mailed 04-02-15", 22 pgs	
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	"Chinese Application Serial No. 200480017704.4, Response filed 01-20-12 to Office Action mailed 12-08-12", (w/ English Translation of Amended Claims), 10 pgs.	
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	"Chinese Application Serial No. 201380033231.6, Office Action mailed 09-21-15", w/ Partial English Translation, 6 pgs	
	"Chinese Application Serial No. 201380033231.6, Response filed 01-14-16 to Office Action mailed 09-21-15", w/English Claims, 7 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 01-16-18", (English Translation), 8 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 07-12-17", W/ English Translation, 8 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 07-25-16", (With English Translation), 4 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 12-23-16", W/ English Translation, 39 pgs	
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	"Chinese Application Serial No. 201480025701.9, Response filed 03-27-18 to Office Action mailed 01-16-18", w/ English Claims, 20 pgs	
	"Chinese Application Serial No. 201480025701.9, Response filed 09-15-17 to Office Action mailed 07-12-17", w/ English Translation, 21 pgs	
	"DARCO® FGD- Powdered Activated Carbon", Norit Americas Inc. Datasheet No. 1100, (May 2009), 1 pg	
	"DATABASE WPI Week 197450", Thomson Scientific, London, GB; AN 1974-86199V XP002514926	
	"European Application Serial No. 05814011.2, Response filed 09-09-11 to European Search Report mailed 04-14-09 and Office Actioin mailed 11-05-09", 20 pgs.	
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	"European Application Serial No. 05814011.2, Decision to grant mailed 06-08-12", 2 pgs	
	"European Application Serial No. 05814011.2, Extended European Search Report mailed 04-14-09", 13 pgs	
	"European Application Serial No. 05814011.2, Office Action mailed 01-25-08", 2 pgs.	
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	"European Application Serial No. 05814011.2, Office Action mailed 04-27-12", 6 pgs	
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	"European Application Serial No. 05814011.2, Partial European Search Report mailed 04-14-09", 13 pgs.	
	"European Application Serial No. 05814011.2, Response filed 02-28-12 to Office Action mailed 01-31-12", 30 pgs	
	"European Application Serial No. 05814011.2, Response filed 04-18-08 to Office Action mailed 01-25-08 and Third Party Observations submitted 12-04-07", 7 pgs.	
	"European Application Serial No. 05814011.2, Response filed 05-11-10 to Communication Pursuant to Article 94(3) EPC mailed 11-05-09", 11 pgs	
	"European Application Serial No. 05814011.2, Response filed 05-11-10 to Office Action mailed 11-05-09", 11 pgs.	
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	"European Application Serial No. 05814011.2, Third Party Observations submitted 03-19-12", 7 pgs.	
	"European Application Serial No. 05814011.2, Third Party Observations submitted 12-04-07", 5 pgs.	
	"European Application Serial No. 10767465.7, Decision to grant mailed 04-17-14", 2 pgs	
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	"European Application Serial No. 10767465.7, Intention to Grant mailed 03-17-14", 44 pgs	

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	"European Application Serial No. 10767465.7, Intention to Grant mailed 09-30-13", 44 pgs	
	"European Application Serial No. 10767465.7, Response filed 02-03-14 to Intention to Grant mailed 09-30-13", 11 pgs	
	"European Application Serial No. 10767465.7, Response filed 06-20-13 to Extended European Search Report mailed 12-06-12", 18 pgs	
	"European Application Serial No. 11189249.3, Communication Pursuant to Article 94(3) EPC mailed 11-26-12", 4 pgs	
	"European Application Serial No. 11189249.3, Decision to Refuse mailed 12-19-13", 18 pgs	
	"European Application Serial No. 11189249.3, Extended European Search Report mailed 02-01-12", 7 pgs	
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	"European Application Serial No. 11189249.3, Response filed 02-04-13 to Communication Pursuant to Article 94(3) EPC mailed 11-26-12", 9 pgs	
	"European Application Serial No. 11189249.3, Response filed 08-28-12 to Extended European Search Report mailed 02-01-12", 9 pgs	
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	"European Application Serial No. 11189252.7, Decision to grant mailed 05-02-14", 2 pgs	
	"European Application Serial No. 11189252.7, Extended European Search Report mailed 01-23-12", 6 pgs	
	"European Application Serial No. 11189252.7, Extended European Search Report mailed 05-09-12", 12 pgs	
	"European Application Serial No. 11189252.7, Office Action mailed 10-30-13", 4 pgs	
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	"European Application Serial No. 11189252.7, Response filed 11-22-12 to Extended European Search Report mailed 05-09-12", 13 pgs	
	"European Application Serial No. 11189252.7, Summons to Attend Oral Proceedings mailed 04-15-13", 6 pgs	
	"European Application Serial No. 13719338.9, Notification Regarding Rule 164 and Article 94(3) EPC mailed 04-24-17", 8 pgs	
	"European Application Serial No. 13719338.9, Office Action mailed 05-12-17", 6 pgs	
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	"European Application Serial No. 13719338.9, Response filed 06-29-15 to Office Action mailed 12-19-14", 19 pgs.	
	"European Application Serial No. 14711106.6, Communication Pursuant to Article 94(3) EPC mailed 02-22-17", 6 pgs	
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	"Response filed 09-04-17 to Notification Regarding Rule 164 and Article 94(3) EPC mailed 04-24-17", 7 pgs	
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* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 17 of 19	Attorney Docket No: 4820.001US9	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	GOMEZ-AVILES, A., et al., "Multifunctional materials based on graphene-like/sepiolite nanocomposites", Applied Clay Science, 47, (2010), 203-211	
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EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 07/23/2018

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Sheet 18 of 19	Attorney Docket No: 4820.001US9	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS		
Examiner Initial *	**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, page(s), volume-issue number(s), publisher, city and/or country where published.**	**T1**
	OLSON, EDWIN S., et al., "Surface Compositions of Carbon Sorbents Exposed to Simulated Low-Rank Coal Flue Gases", J. Air & Water Waste Manage. Assoc., 55, (2005), 747-754	
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/974,343	05/08/2018	Edwin S. Olson	4820.001US9	1072

21186 7590 07/06/2018

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402
UNITED STATES OF AMERICA

EXAMINER
ORLANDO, AMBER ROSE

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
07/06/2018	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Doc Code:
TRACK1.GRANT

Decision Granting Request for Prioritized Examination (Track I or After RCE)	Application No.: 15/974,343

1. THE REQUEST FILED May 8, 2018 IS **GRANTED.**

The above-identified application has met the requirements for prioritized examination
- A. ☒ for an original nonprovisional application (Track I).
- B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination.** The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

- A. filing a **petition for extension of time** to extend the time period for filing a reply;
- B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims**, or a multiple dependent claim;
- C. filing a **request for continued examination**;
- D. filing a notice of appeal;
- E. filing a request for suspension of action;
- F. mailing of a notice of allowance;
- G. mailing of a final Office action;
- H. completion of examination as defined in 37 CFR 41.102; or
- I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to Cheryl Gibson-Baylor at (571)272-3213, Office of Petitions. In his/her absence, calls may be directed to Brian W. Brown, (571)272-5338.

Cheryl Gibson-Baylor
/Cheryl Gibson-Baylor/
[*Signature*]

Petitions Paralegal Specialist
(Title)

Office of Petitions: Decision Count Sheet

Mailing Month: 7

Application No.: 15974343

15974343

For US serial numbers: enter number only, no slashes or commas. Ex: 10123456
For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official: GIBSON-BAYLOR, CHERYL

Count (1) - Palm Credit 15974343

Decision: GRANT

FINANCE WORK NEEDED
☐ Select Check Box for YES

GRANT

Decision Type: 643 - Track One request

643

Notes:

Count (2)

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Count (3)

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Initials of Approving Official (if required)

If more than 3 decisions, attach 2nd count sheet & mark this box ☐

Printed on: 7/2/2018

Office of Petitions Internal Document - Ver. 5.0

Office of Petitions: Routing Sheet



Application No. 15974343

This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application, as indicated below. For details of this decision, please see the document PET.OP.DEC filed on the same date as this document.

- [X] **GRANTED**
- [ ] **DISMISSED**
- [ ] **DENIED**

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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
15/974,343	05/08/2018	1736	1720	4820.001US9	16	1

CONFIRMATION NO. 1072

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

FILING RECEIPT

OC000000100034131

Date Mailed: 06/06/2018

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)

Edwin S. Olson, Grand Forks, ND;
Michael J. Holmes, Thompson, ND;
John H. Pavlish, East Grand Forks, MN;

Applicant(s)

Midwest Energy Emissions Corp, Lewis Center, OH;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/951,970 04/12/2018
which is a CON of 14/712,558 05/14/2015
which is a CON of 14/318,270 06/27/2014 PAT 9757689 *
which is a CON of 13/966,768 08/14/2013 PAT 8821819
which is a CON of 13/427,665 03/22/2012 PAT 8512655
which is a CON of 12/419,219 04/06/2009 PAT 8168147
which is a CON of 12/201,595 08/29/2008 ABN
which is a CON of 11/209,163 08/22/2005 PAT 7435286
which claims benefit of 60/605,640 08/30/2004
(*)Data provided by applicant is not consistent with PTO records.

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.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/05/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/974,343**

Projected Publication Date: 09/13/2018

Non-Publication Request: No

Early Publication Request: No

Title

SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Preliminary Class

423

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/974,343

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			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	16 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 460 =	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			TOTAL	1720

APPLICATION AS AMENDED - PART II

AMENDMENT A

	(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
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	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
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

Modified form PTO/SB/08A(04-07) OMB 651-0031
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	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 1 of 19	Attorney Docket No: 4820.001US9	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
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	US-20010002387A1	5/31/2001	Tsutsumi, Yoshio, et al.
	US-20010003116A1	6/7/2001	Neufert, Ronald
	US-2002/01505a1	10/17/2002	Pahlman, John E, et al.
	US-20020033097A1	3/21/2002	El-shoubary, Youssef, et al.
	US-20020043496A1	4/18/2002	Boddu, Veera M., et al.
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	Application Number	15/974,343
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	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
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	"Application Serial No. 12/201,595, Final Office Action mailed 03-10-10", 13 pgs.	

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	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 8 of 19	Attorney Docket No: 4820.001US9	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"Application Serial No. 12/201,595, Non Final Office Action mailed 04-16-09", 21 pgs.	
	"Application Serial No. 12/201,595, Response filed 10-16-09 to Non Final Office Action mailed 04-16-09", 18 pgs	
	"Application Serial No. 12/419,219, Final Office Action mailed 10-14-10", 17 pgs	
	"Application Serial No. 12/419,219, Non Final Office Action mailed 01-15-10", 13 pgs	
	"Application Serial No. 12/419,219, Non Final Office Action mailed 02-23-11", 17 pgs	
	"Application Serial No. 12/419,219, Non Final Office Action mailed 08-04-11", 16 pgs.	
	"Application Serial No. 12/419,219, Notice of Allowance Mailed 01-10-12", 7 pgs	
	"Application Serial No. 12/419,219, Preliminary Amendment filed 04-06-09", 7 pgs	
	"Application Serial No. 12/419,219, Response filed 02-14-11 to Final Office Action mailed 10-14-10", 19 pgs.	
	"Application Serial No. 12/419,219, Response filed 05-20-11 to Non Final Office Action mailed 02-23-11", 14 pgs	
	"Application Serial No. 12/419,219, Response filed 07-15-10 to Non Final Office Action mailed 01-15-10", 22 pgs	
	"Application Serial No. 12/419,219, Response filed 10-27-11 to Non Final Office Action mailed 08-04-11", 12 pgs	
	"Application Serial No. 12/429,058, Advisory Action mailed 05-29-12", 3 pgs	
	"Application Serial No. 12/429,058, Ex Parte Quayle Action mailed 02-14-13", 7 pgs	
	"Application Serial No. 12/429,058, Examiner Interview Summary mailed 12-28-12", 4 pgs	
	"Application Serial No. 12/429,058, Final Office Action mailed 10-31-12", 21 pgs	
	"Application Serial No. 12/429,058, Final Office Action mailed 12-20-11", 21 pgs	
	"Application Serial No. 12/429,058, Non Final Office Action mailed 06-11-12", 18 pgs	
	"Application Serial No. 12/429,058, Non Final Office Action mailed 07-19-11", 20 pgs	
	"Application Serial No. 12/429,058, Notice of Allowance mailed 01-16-14", 5 pgs	
	"Application Serial No. 12/429,058, Notice of Allowance mailed 09-11-13", 11 pgs	
	"Application Serial No. 12/429,058, Response filed 01-31-13 to Final Office Action mailed 10-31-12", 19 pgs	
	"Application Serial No. 12/429,058, Response filed 03-07-13 to Ex Parte Quayle Action mailed 02-14-13", 7 pgs	
	"Application Serial No. 12/429,058, Response filed 05-11-12 to Final Office Action mailed 12-20-11", 11 pgs	
	"Application Serial No. 12/429,058, Response filed 09-11-12 to Non Final Office Action mailed 06-11-12", 16 pgs	
	"Application Serial No. 12/429,058, Response filed 10-18-11 to Non Final Office Action mailed 07-19-11", 17 pgs	
	"Application Serial No. 13/427,665, Non Final Office Action mailed 01-04-13", 23 pgs.	
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	"Application Serial No. 13/427,665, Notice of Allowance mailed 04-16-13", 8 pgs	
	"Application Serial No. 13/427,665, Response filed 03-21-13 to Non Final Office Action mailed 01-04-13", 20 pgs	
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	"Application Serial No. 13/453,274, Final Office Action mailed 10-16-14", 4 pgs	
	"Application Serial No. 13/453,274, Non Final Office Action mailed 05-30-14", 6 pgs.	
	"Application Serial No. 13/453,274, Notice of Allowance mailed 01-05-15", 5 pgs	
	"Application Serial No. 13/453,274, Response filed 09-02-14 to Non Final Office Action mailed 05-30-14", 13 pgs.	
	"Application Serial No. 13/453,274, Response filed 11-06-14 to Final Office Action mailed 10-16-14", 7 pgs.	
	"Application Serial No. 13/453,274, Response filed 12-09-14 to Advisory Action mailed 11-24-14", 6 pgs	
	"Application Serial No. 13/966,768, Non Final Office Action mailed 12-06-13", 7 pgs.	
	"Application Serial No. 13/966,768, Notice of Allowability mailed 08-01-14", 6 pgs	
	"Application Serial No. 13/966,768, Notice of Allowance mailed 04-18-14", 7 pgs	
	"Application Serial No. 13/966,768, Preliminary Amendment filed 08-14-13", 3 pgs.	
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	"Application Serial No. 14/102,896, Advisory Action mailed 12-16-15", 3 pgs	
	"Application Serial No. 14/102,896, Final Office Action mailed 08-26-15", 12 pgs	
	"Application Serial No. 14/102,896, Non Final Office Action mailed 03-23-15", 13 pgs	
	"Application Serial No. 14/102,896, Notice of Allowance mailed 06-10-16", 7 pgs	
	"Application Serial No. 14/102,896, Response filed 01-22-16 to Advisory Action mailed 12-16-15", 11 pgs	
	"Application Serial No. 14/102,896, Response filed 06-22-15 to Non Final Office Action mailed 03-23-15", 10 pgs	
	"Application Serial No. 14/102,896, Response filed 11-24-15 to Final Office Action mailed 08-26-15", 5 pgs	
	"Application Serial No. 14/195,360, Corrected Notice of Allowance mailed 02-27-17", 2 pgs	
	"Application Serial No. 14/195,360, Corrected Notice of Allowance mailed 03-29-17", 2 pgs	
	"Application Serial No. 14/195,360, Final Office Action mailed 03-18-16", 18 pgs	
	"Application Serial No. 14/195,360, Final Office Action mailed 11-22-16", 7 pgs	

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	Examiner Name	Unknown
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	"Application Serial No. 14/195,360, Non Final Office Action mailed 06-20-16", 11 pgs	
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	"Application Serial No. 14/195,360, Non Final Office Action mailed 11-24-15", 19 pgs	
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	"Application Serial No. 14/195,360, Response filed 01-18-17 to Final Office Action mailed 11-22-16", 7 pgs.	
	"Application Serial No. 14/195,360, Response filed 02-22-16 to Non Final Office Action mailed 11-24-15", 21 pgs.	
	"Application Serial No. 14/195,360, Response filed 05-17-16 to Final Office Action mailed 03-18-16", 15 pgs	
	"Application Serial No. 14/318,270, Advisory Action mailed 02-17-17", 4 pgs	
	"Application Serial No. 14/318,270, Corrected Notice of Allowance mailed 05-22-17", 2 pgs	
	"Application Serial No. 14/318,270, Final Office Action mailed 11-25-16", 25 pgs	
	"Application Serial No. 14/318,270, Non Final Office Action mailed 06-02-16", 24 pgs	
	"Application Serial No. 14/318,270, Notice of Allowance mailed 05-15-17", 8 pgs	
	"Application Serial No. 14/318,270, Response filed 01-25-17 to Final Office Action mailed 11-25-16", 14 pgs	
	"Application Serial No. 14/318,270, Response filed 02-27-17 to Final Office Action mailed 11-25-16", 15 pgs	
	"Application Serial No. 14/318,270, Response filed 03-02-16 to Restriction Requirement mailed 01-14-16", 9 pgs.	
	"Application Serial No. 14/318,270, Response filed 08-22-16 to Non Final Office Action mailed 06-02-16", 14 pgs.	
	"Application Serial No. 14/318,270, Restriction Requirement mailed 01-14-16", 8 pgs	
	"Application Serial No. 14/564,860, Final Office Action mailed 11-17-16", 4 pgs	
	"Application Serial No. 14/564,860, Non Final Office Action mailed 07-12-16", 6 pgs	
	"Application Serial No. 14/564,860, Notice of Allowance mailed 01-30-17", 6 pgs	
	"Application Serial No. 14/564,860, Preliminary Amendment filed 12-10-14", 8 pgs	
	"Application Serial No. 14/564,860, Preliminary Amendment filed 12-10-14", 6 pgs.	
	"Application Serial No. 14/564,860, Response filed 05-06-16 to Restriction Requirement mailed 03-16-16", 9 pgs.	
	"Application Serial No. 14/564,860, Response filed 10-03-16 to Non Final Office Action mailed 07-12-16", 11 pgs	
	"Application Serial No. 14/564,860, Restriction Requirement mailed 03-16-16", 5 pgs	
	"Application Serial No. 14/712,558, Advisory Action mailed 02-12-18", 8 pgs	
	"Application Serial No. 14/712,558, Examiner Interview Summary mailed 03-05-18", 3 pgs	
	"Application Serial No. 14/712,558, Final Office Action mailed 12-06-17", 9 pgs	
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	"Application Serial No. 14/712,558, Response filed 01-23-18 to Final Office Action mailed 12-06-17", 13 pgs	
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	"Application Serial No. 14/712,558, Supplemental Amendment Filed 5-15-2018", 6 pgs.	
	"Application Serial No. 14/712,558, Supplemental Preliminary Amendment filed 05-15-15", 6 pgs	
	"Application Serial No. 15/295,594, Preliminary Amendment filed 01-26-17", 8 pgs	
	"Application Serial No. 15/295,594, Preliminary Amendment filed 06-13-17", 7 pgs	
	"Application Serial No. 15/382,114, Preliminary Amendment filed 04-04-17", 3 pgs	
	"Application Serial No. 15/449,112, Advisory Action mailed 04-24-18", 3 pgs	
	"Application Serial No. 15/449,112, Final Office Action mailed 02-15-18", 13 pgs	
	"Application Serial No. 15/449,112, Non Final Office Action mailed 09-27-17", 17 pgs	
	"Application Serial No. 15/449,112, Response filed 01-16-18 to Non Final Office Action mailed 09-27-17", 16 pgs	
	"Application Serial No. 15/449,112, Response filed 02-15-18 to Final Office Action mailed 02-15-18", 13 pgs.	
	"Application Serial No. 15/449,112, Response filed 04-06-18 to Final Office Action mailed 02-15-18", 13 pgs	
	"Application Serial No. 15/452,527, Preliminary Amendment filed 03-08-17", 3 pgs.	
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	"Application Serial No. 15/589,359, Preliminary Amendment filed 01-03-18", 6 pgs	
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	"Application Serial No.14/195,360, Response filed 09-16-16 to Non Final Office Action mailed 06-30-16", 12 pgs.	
	"Bromine and its Compounds", Jolles, Z. E., Editor, Academic Press, Inc., New York, NY, (1966), pgs. 193 and 205	
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	"Canadian Application Serial No. 2,584,327, Office Action mailed 12-07-09", 2 pgs	
	"Canadian Application Serial No. 2,584,327, Response filed 03-19-10 to Office Action mailed 12-07-09", 8 pgs	

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	"Canadian Application Serial No. 2,584,327, Response filed 09-02-09 to Office Action mailed 03-03-09", 21 pgs	
	"Canadian Application Serial No. 2,707,363, First Examiners Report Received 6/16/11", 2 pgs	
	"Canadian Application Serial No. 2,757,309, Office Action mailed 12-07-15", 3 pgs	
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	"Canadian Application Serial No. 2,871,422, Response filed 02-26-16 to Office Action mailed 09-09-15", 13 pgs.	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 04-02-15", 5 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 08-31-17", 4 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 09-09-15", 3 pgs	
	"Canadian Application Serial No. 2,871,422, Office Action mailed 12-22-16", 5 pgs	
	"Canadian Application Serial No. 2,871,422, Response filed 02-26-18 to Office Action mailed 08-31-17", w/ Amended Claims, 53 pgs	
	"Canadian Application Serial No. 2,871,422, Response filed 06-21-17 to Office Action mailed 12-22-16", 41 pgs	
	"Canadian Application Serial No. 2,871,422, Response filed 08-28-15 to Canadian Office Action mailed 04-02-15", 22 pgs	
	"Chinese Application Serial No. 200480017704.4, Office Action mailed 12-08-11", (w/ English Translation), 6 pgs	
	"Chinese Application Serial No. 200480017704.4, Response filed 01-20-12 to Office Action mailed 12-08-12", (w/ English Translation of Amended Claims), 10 pgs.	
	"Chinese Application Serial No. 200580037037.0, Chinese Office Action, dated June 25, 2013 (and English translation)", no english translation, 46 pgs	
	"Chinese Application Serial No. 201380033231.6, Office Action mailed 09-21-15", w/ Partial English Translation, 6 pgs	
	"Chinese Application Serial No. 201380033231.6, Response filed 01-14-16 to Office Action mailed 09-21-15", w/English Claims, 7 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 01-16-18", (English Translation), 8 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 07-12-17", W/ English Translation, 8 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 07-25-16", (With English Translation), 4 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 12-23-16", W/ English Translation, 39 pgs	
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 12-23-16", 24 pgs.	

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	"DARCO® FGD- Powdered Activated Carbon", Norit Americas Inc. Datasheet No. 1100, (May 2009), 1 pg	
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	"European Application Serial No. 05814011.2, Communication Pursuant to Article 94(3) EPC mailed 11-05-09", 4 pgs	
	"European Application Serial No. 05814011.2, Decision to grant mailed 06-08-12", 2 pgs	
	"European Application Serial No. 05814011.2, Extended European Search Report mailed 04-14-09", 13 pgs	
	"European Application Serial No. 05814011.2, Office Action mailed 01-25-08", 2 pgs.	
	"European Application Serial No. 05814011.2, Office Action mailed 01-31-12", 4 pgs	
	"European Application Serial No. 05814011.2, Office Action mailed 04-27-12", 6 pgs	
	"European Application Serial No. 05814011.2, Office Action mailed 11-05-09", 2 pgs.	
	"European Application Serial No. 05814011.2, Partial European Search Report mailed 04-14-09", 13 pgs.	
	"European Application Serial No. 05814011.2, Response filed 02-28-12 to Office Action mailed 01-31-12", 30 pgs	
	"European Application Serial No. 05814011.2, Response filed 04-18-08 to Office Action mailed 01-25-08 and Third Party Observations submitted 12-04-07", 7 pgs.	
	"European Application Serial No. 05814011.2, Response filed 05-11-10 to Communication Pursuant to Article 94(3) EPC mailed 11-05-09", 11 pgs	
	"European Application Serial No. 05814011.2, Response filed 05-11-10 to Office Action mailed 11-05-09", 11 pgs.	
	"European Application Serial No. 05814011.2, Response filed 09-09-11 to Extended European Search Report mailed 04-14-09", 20 pgs	
	"European Application Serial No. 05814011.2, Third Party Observations submitted 03-19-12", 7 pgs.	
	"European Application Serial No. 05814011.2, Third Party Observations submitted 12-04-07", 5 pgs.	
	"European Application Serial No. 10767465.7, Decision to grant mailed 04-17-14", 2 pgs	
	"European Application Serial No. 10767465.7, Extended European Search Report mailed 12-06-12", 5 pgs	
	"European Application Serial No. 10767465.7, Intention to Grant mailed 03-17-14", 44 pgs	

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	"European Application Serial No. 10767465.7, Intention to Grant mailed 09-30-13", 44 pgs	
	"European Application Serial No. 10767465.7, Response filed 02-03-14 to Intention to Grant mailed 09-30-13", 11 pgs	
	"European Application Serial No. 10767465.7, Response filed 06-20-13 to Extended European Search Report mailed 12-06-12", 18 pgs	
	"European Application Serial No. 11189249.3, Communication Pursuant to Article 94(3) EPC mailed 11-26-12", 4 pgs	
	"European Application Serial No. 11189249.3, Decision to Refuse mailed 12-19-13", 18 pgs	
	"European Application Serial No. 11189249.3, Extended European Search Report mailed 02-01-12", 7 pgs	
	"European Application Serial No. 11189249.3, Office Action mailed 11-04-13", 4 pgs	
	"European Application Serial No. 11189249.3, Response filed 02-04-13 to Communication Pursuant to Article 94(3) EPC mailed 11-26-12", 9 pgs	
	"European Application Serial No. 11189249.3, Response filed 08-28-12 to Extended European Search Report mailed 02-01-12", 9 pgs	
	"European Application Serial No. 11189249.3, Summons to Attend Oral Proceedings mailed 04-15-13", 7 pgs	
	"European Application Serial No. 11189252.7, Communication Pursuant to Article 94(3) EPC mailed 01-09-13", 4 pgs	
	"European Application Serial No. 11189252.7, Decision to grant mailed 05-02-14", 2 pgs	
	"European Application Serial No. 11189252.7, Extended European Search Report mailed 01-23-12", 6 pgs	
	"European Application Serial No. 11189252.7, Extended European Search Report mailed 05-09-12", 12 pgs	
	"European Application Serial No. 11189252.7, Office Action mailed 10-30-13", 4 pgs	
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	"European Application Serial No. 11189252.7, Response filed 02-11-13 to Communication Pursuant to Article 94(3) EPC mailed 01-09-13", 5 pgs	
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	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
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Sheet 15 of 19	Attorney Docket No: 4820.001US9	

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(54) PROCESS FOR REMOVING MERCURY FROM MERCURY VAPOUR-CONTAINING GASES

(72) de Jong, Geert J.;
Vos, Hendrik J.,
Netherlands

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ABSTRACT OF THE DISCLOSURE

APR 21 1981

Removal of mercury from mercury vapour-containing gases by passing them continuously through a bed of active carbon on which a halogen is adsorbed having a thickness of at most 5 cm, while maintaining the chlorine content of the active carbon between 5 and 12% by weight. This is preferably effected by adding to said gases chlorine in an amount such that the carbon is caused to absorb a quantity thereof which equals the quantity that is consumed during the adsorption of mercury.

The present invention relates to a process for removing mercury from mercury vapour-containing gases by contacting these gases with activated carbon on which a halogen is adsorbed.

A process of the type indicated above disclosed, inter alia, in United States Patent Specifications Nos. 1,984,164 and 3,849,267. According to the former patent specification a halogen, more particularly iodine, is previously applied to the carbon, whereas according to the latter patent specification a gas containing mercury and chlorine is passed over activated carbon, as a result of which the mercury content of the gas can be reduced to 0.01 mg/m^3.

Moreover, in Soviety Chemical Industry 1972 (no. 8) p. 535-536, and from Tsvet. Metally, 1958 (31) p. 31-37, the use is disclosed of carbon loaded with chlorine as adsorbent of mercury-containing gases. In these publications mention is made of chlorine contents of the carbon which do not exceed 4% of the carbon weight. For practical purposes the methods described are not attractive in that the filter thicknesses required are unacceptably high or the residual concentrations of mercury are higher than the ones obtained with the present invention.

Applicant has found that the long-term effectiveness of these methods is very much dependent on the halogen content of the activated carbon and that a process for the continuous removal of mercury vapour from large amounts of gas is only suitable to be applied in actual practice if the activated carbon contains chlorine in an amount which is between particular critical limits.

According to the present invention in a process of the type indicated heretofore the gas to be freed from mercury vapour is continuously passed through a bed of activated carbon having a maximum thickness of 5 cm, care being taken that during said passage the activated carbon has a chlorine content in the range of from 5 to 12% by weight.

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It has been found that the use of a lower chlorine content will result in the bed retaining a low percentage of mercury. A total absence of chlorine will cause this percentage to be lower than 50%; and after a few days it will drop to a few per cent. The total amount of mercury which can be retained by the carbon then will be well below 0.1% mercury, calculated on the weight of the carbon. At a chlorine content which is somewhat lower than the minimum amount required the percentage of mercury collected will initially be good (over 90% of the mercury present can be collected initially). But this percentage will rapidly decrease to below 60% and the carbon will be found to be irreversibly clogged. In other words the effectiveness of the carbon cannot be restored by a chlorinating treatment then and regeneration of the carbon by removing the mercury collected by it is not very well feasible. At a chlorine content above the above-mentioned maximum limit the carbon is found to release much chlorine during the process and moreover, especially when the air passed through contains a high percentage of moisture, the carbon will be attacked, resulting in mechanical weakening; it must therefore be sooner replaced than when the chlorine content is within the above-specified limits. The chlorine content can be kept between the afore-mentioned limits in a simple manner by adding such an amount of chlorine to the gas that the carbon will adsorb therefrom as much chlorine as will be lost from it during the adsorption of the mercury. This loss of chlorine during the adsorption of the mercury is the result on the one hand of desorption and on the other of the formation on the carbon of mercury chloride, and is moreover due to reactions between chlorine and other constituents of the air, particularly water. It has been found that a stable situation can be reached when the chlorine content of the gas is such that per atom of mercury 15 to 25 atoms of chlorine are present in it. To this continuous feeding of chlorine there may be very special advantages. Such is the case when the

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gases to be treated already contain some chlorine, which will inevitably be present in it in a very low concentration for instance in rooms in which common salt is subjected to hydrolysis. Chlorine need then be added only until the desired level has been reached.

It should be noted that according to United States Patent Specification 3,849,267 (column 2, lines 1-10) gas containing mercury and chlorine also is brought into contact with activated carbon. In that case, however, the chlorine content is not controlled; for as minimum concentration of mercury contained in the purified gas 0.01 mg per m^3 is mentioned. This points to the fact that the chlorine content of the carbon must have been beyond the limits indicated.

Another particularly attractive way of keeping the chlorine content of the activated carbon within the limits indicated consists in that the carbon is periodically contacted with a chlorine-containing gas. In this periodic chlorine make-up it must be ensured that the chlorine content of the activated carbon does not temporarily get beyond the limits indicated, in which case the above-described disadvantages may be encountered. In actual practice it is found that when the chlorine content is made up once a week very favourable results can be obtained. For in one week the collecting capacity of the carbon for mercury is reduced by as little as less than 5 per cent. By subsequently contacting the activated carbon with a chlorine-containing gas the original collecting capacity is restored. The amount of chlorine the activated carbon is made to adsorb when it is periodically treated with a chlorine-containing gas may for instance be 0.30-0.40% of the weight of the carbon.

It has been found that use of the process according to the invention may lead to very favourable results with gases having a mercury content of about 0.01-0.15 mg/m^3. According to the inven-

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tion, this content may be reduced to 0.001-0.008 mg/m^3, which is a level that is quite acceptable under all circumstances and cannot be attained with any of the known processes. At higher mercury contents of the gas to be purified it is recommended that the air should first be subjected to some other mercury-desorbing process, for instance by washing with a sodium hypochlorite solution or using the method described in United States Patent Specification 3,849,267.

Further advantages of the present method are that the desired result can be obtained with very short contacting times in the range of 25 to 100 milliseconds and that, depending on the initial mercury content and the chosen contacting time, the percentage mercury collected is between 85 and 99%. Owing to the short contacting times there is only need to use thin (and hence inexpensive) carbon beds. Excellent results are obtained with a carbon bed having a thickness of, for instance, 2 cm. With the process according to the invention it is generally possible with 1 kg of activated carbon to treat gas at a rate of 50 to 200 m^3 per hour. In the process according to the invention the effective life of the carbon is extraordinarily long. At a mercury content of the gas of 0.05 mg/m^3 and a passage of 100 m^3/h per kg of carbon the expected effective life obtained according to the present invention is over 400 days.

Should the carbon be loaded with mercury, i.e. mercury chloride, to such a degree that its effectiveness will decrease, then it can be regenerated in a simple manner for instance by washing with an aqueous liquid containing chloride ions. In a mercury electrolysis apparatus preferably use is made for this purpose of process liquids, so that the mercury compounds released upon regeneration are fed back into the process and no secondary contamination takes place during regeneration. After the greater part of the mercury present has been removed, the carbon is washed

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with water to get rid of any clogging salts. After drying and loading with chlorine the carbon is ready to beused in a new adsorption period.

Regeneration of the carbon loaded with mercury is possible in that the mercury is present on it in the form of mercury chloride which is converted into water-soluble complex compound in a chloride-containing aqueous solution.

An unduly high moisture content of the gas from which mercury is to be removed should be avoided because the effectiveness of the activated carbon is reduced then and water is collected instead of mercury. It is preferred that the relative humidity should be kept below 75%. The relative humidity can be controlled in such a way that the excess water is isolated by previous cooling or the gas is heated to a temperature such that the desired relative humidity is obtained.

In the process according to the invention use may be made of normal activated carbon.. So there is no need to employ specially prepared carbons or other costly sorbents. Preference is given to the use of extruded carbon granules having a diameter of about 1.5 mm. The process according to the invention may be applied in the removal of mercury from, for instance, hydrogen gas. The process is particularly suitable for the removal of mercury from air which is vented from plant buildings by fans. The mercury content of such air is usually low because people who have to work in it must not be exposed to high mercury concentrations. The volumes of air to be discharged then are therefore generally large.

The process according to the invention is attractive especially in that it provides an inexpensive treatment of very large volumes of air having a low mercury content. As a result, even small environmental pollution by mercury can still be further reduced. If the air to be purified is not dust-free, this does not present any difficulty because the presence of dust does not have

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any unfavourable influence on the process.

As the usual fans generally have a small head, the air to be vented by them can be passed only through filters having a low resistance. That is why the process according to the invention is so important; for the filters to be used need only have a small thickness.

The present invention is further illustrated by way of the following Examples.

Example 1

From a room in which sodium chloride is subjected to electrolysis by the amalgamation process air is withdrawn at a rate of 10.10^6 m^3 per hour by means of 25 fans.
This air contains mercury vapour in an amount of about 0.05 mg/m^3. Per fan, this air, which has a relative humidity of 50% at a temperature of 32°C, is passed through a filter bed having a surface area of 37 m^2. The air displacement per fan is 40×10^3 m/h. The bed is formed by a 1.6 cm thick layer of granules of activated carbon 1.5 mm in diameter. The pressure drop across the filters is less than 10 mm hydrostatic head. The amount of carbon is 358 kg per fan. Before use the carbon is contacted with a chlorine-containing gas until the chlorine content is 7% by weight. The air is passed through the filters at a rate of 0.6 m/sec., so that the contacting time is 27.10^{-3} sec. After the air has left the filter, its mercury content is less than 0.004 mg/cm^3, so that the effectiveness of the filter under these conditions is more than 92%. After the filter has been in use for a week, its effectiveness has decreased to 89%.

Then air containing 60 mg of chlorine per m^3 is passed through for 30 minutes and the free chlorine content of the activated carbon is restored to 7% by weight. Upon the subsequent passage of mercury-containing air the effectiveness of the mercury removal is again found to be more than 92%.

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After one year's operation of the system in the above-described way the mercury content of the carbon is 4.3% by weight. The carbon is then regenerated by washing for 10 hours with a concentrated hydrochloric acid solution. Subsequently the hydrochloric acid is removed by washing with water, after which the carbon is dried by passing air through it.

When the carbon is dry (drying time about 1 hour), it is loaded with chlorine up to the original level, after which it is ready again for further adsorption. In an experiment in which the chlorine content is made up when the effectiveness of the mercury removal is 86%, it can be restored to 92% in the above-described way. In an experiment in which the chlorine make-up is not carried out until the effectiveness of the mercury removal has decreased to 84%, it is found that it can no longer be restored to 92% by chlorine make-up. The chlorine content has then been reduced by adsorption to a level such that the decrease has become irreversible.

Example 2

From a room in which sodium chloride is subjected to electrolysis by the amalgamation process air is withdrawn in the way described in Example 1. The air is treated in the manner indicated in Example 1, except that the carbon is not periodically brought into contact with a chlorine-containing gas. In this case the chlorine content of the carbon is kept at the desired level by having the fan air continuously contain a small amount of chlorine.

The chlorine content of the air is 0.35 p.p.m.

In this way the effectiveness of the mercury removal can be kept at 92% for a year, with the mercury content of the purified air amounting to less than 0.004 mg/m^3.

When the chlorine content of the air has been reduced until the effectiveness is less than 84%, the decrease is found to be irreversible. By increasing the chlorine feed rate it can no long be restored then to the originally high level.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. In a process for removing mercury from a mercury vapour-containing gas by contacting the gas with activated carbon on which a halogen is adsorbed, the improvement in which the gas to be freed from mercury vapour is continuously passed through a bed of activated carbon having a maximum thickness of 5 cm, care being taken that during said passage the activated carbon has a chlorine content in the range of from 5 to 12% by weight.

2. A process according to claim 1, in which the chlorine content of the activated carbon is kept within said limits by adding such an amount of chlorine as is lost from it during the adsorption of the mercury.

3. A process according to claim 2, in which the chlorine content of the gas is such that per atom of mercury 15 to 20 atoms of chlorine are present.

4. A process according to claim 1, in which the chlorine content of the activated carbon is kept between said limits by periodically contacting the carbon with a chlorine-containing gas.



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SUBSTITUTE

REMPLACEMENT

SECTION is not Present

Cette Section est Absente

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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Method and Apparatus for Continuously Separating Mercury from Flowing Gases

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(30) (DE) P 44 22 661.6 1994/06/28

(57) 21 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.

ABSTRACT OF THE DISCLOSURE.

A method and apparatus for the continuous separation of mercury from flowing gases, in particular from exhaust gases from thermal processes, e.g. melting of mercury containing glas shards from fluorescent lamps. At least one halogen, in particular iodine and/or bromine, is added to the gases when they flow into a reaction vessel. The halogen reacts with the mercury to form mercury halide, which is separated in the solid state from the gases prior to their outflow from the reaction vessel, for example by deposition on a cooled metal surface or by filtration. Excess halogen is separated by means of adsorption. A regulating device is optionally provided which readjusts the feed rate of the halogen in such a way that a predetermined small mercury concentration is set in the outflowing gases, e.g. less than 0.2 mg per m^3 of gas.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

"METHOD AND APPARATUS FOR CONTINUOUSLY SEPARATING MERCURY FROM FLOWING GASES"

Reference to related patent and application, the disclosures of which are hereby incorporated by reference:

U.S. 4,729,882, Ide et al.;

International Application PCT/EP 92/01557, published WO 93/02773, U.S. designated, Kürzinger et al.

Reference to related patents:

European 0 289 810 A1, Vogg;

German 41 40 969 C1, Körner et al.

* * * * * * *

FIELD OF THE INVENTION.

The present invention relates to an apparatus and method for continuously separating mercury from flowing gases, in particular from exhaust gases of thermal processes. Such gases arise during operation of a glass melting installation for fragmented mercury-containing lightbulbs, e.g. fluorescent lamps or metal halide lamps.

BACKGROUND.

Conventionally, some mercury separation methods employ activated charcoal for binding the mercury. For example, the activated charcoal may be in the form of filters or screens, and

possibly used for pre-cleaning (for example WO 93/02773, Kürzinger et al.). Since activated charcoal is highly flammable, its employment is limited to cleaning gases at an appropriately low temperature.

The following methods are suitable for higher gas temperatures. Lime, to which green coke has been added, is used as the reaction agent for binding mercury, see EP 0 289 810. The mercury-green coke-adsorbate being generated is separated in a precipitator and stored. A large amount of special waste is generated, which is disadvantageous for this type of method.

Another method involves bringing the mercury- containing gases into contact with precious metal halides. In such a method, the precious metals are reduced and the corresponding mercury halide is separated. However, high costs are incurred because of the use of precious metals.

Some amalgam-forming methods are known. In the simplest case, a sheet metal plate forming an amalgam is disposed in the gas flow. The relatively small surface and the resultant short service times are disadvantageous. To avoid this problem, it is proposed in the German Patent Disclosure Document DE-OS 41 40 969 to apply amalgam-forming metals, for example gold, silver, copper, tin, zinc, palladium, iridium, or rhodium, on a substrate with a large inner specific surface (up to approximately 90 m^2/g). However, the cost of these metallized substrates is high.

A method for cleaning mercury-containing gases from municipal waste incineration plants is disclosed in US Patent No. 4,729,882, Ide et al. In a first method step the mercury is converted to water-soluble mercury chloride by the addition of chlorine gas. The mercury is washed out of the gas in a subsequent wet-chemical method step by means of a washing solution. However, the high chemical aggressiveness of chlorine is disadvantageous. Furthermore, wet washing causes an additional pressure loss in the gas flow which is equivalent to an increased energy outlay.

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THE INVENTION.

It is an object of the invention to provide an efficient method and apparatus for separating mercury (Hg) from gases on a large industrial scale and so that the threshold values for mercury concentrations in exhaust air fall below those prescribed in the relevant regulations, while overcoming the previously mentioned disadvantages.

Briefly, at least one halogen X, in particular iodine and/or bromine, is admixed directly and continuously at a controllable feed rate to mercury-containing gas in order to thereby trigger a quantitative reaction of $Hg + X_2 \longrightarrow HgX_2$. By means of this reaction the concentration of elementary mercury in the gas flow is directly reduced. The mercury halide(s) HgX_2 generated in the course of the reaction is or are subsequently separated in the solid state from the gas flow, possibly together with further mercury compounds present in the gas flow.

Iodine is a preferred reactant, because it reacts well with mercury to form mercury iodide. It is furthermore advantageous in that as compared to chlorine and fluorine, iodine is clearly less chemically aggressive. In addition, mercury iodide has a lesser water solubility (approximately 0.006%) than mercury bromide (approximately 0.62%), mercury chloride (approximately 6.9%) and mercury fluoride (dissociates), as well as a relatively high evaporation temperature (approximately 354°C). Because of this, the humidity and temperature of mercury-containing exhaust gases have a lesser effect on the separation of the mercury iodide than with the other mercury halides mentioned. In spite of this, however, it is possible in principle to employ halogens other than iodine as reactants, provided a reduced efficiency of the separation is acceptable. It is also possible to use two or more different types of halogens simultaneously as reactants.

In a first embodiment of the invention, the halogen is

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continuously supplied in manually preset amounts. Optionally, the feed rate of the halogen(s) is increased to such a degree that the gas flow shows an excess of halogen. In this manner, the elemental mercury can be completely converted to the greatest extent into mercury halide(s) and separated from the gas flow. The excess halogen contained in the gas flow after the reaction is separated in a further method step.

In a second embodiment of the method, the mercury concentration is selectively and continuously measured following the reaction. The feed rate of the halogen(s) is readjusted as a function of the measured value in such a way that a preselectable threshold value of the mercury concentration occurs, particularly less than 0.2 mg mercury per m^3 of exhaust gas. In a preferred embodiment of the method, the mercury concentration is adjusted to a value which, although lying below a prescribed threshold value, lies above zero. Overdosing with halogen is prevented in this manner, even with fluctuating mercury concentrations in the inflowing gas. Accordingly, in this embodiment it is possible to omit the additional method step for separating excess halogen, which is generally required with the uncontrolled method. A further advantage is the flexible adaptation of the supplied amount of halogen to fluctuating mercury concentrations. Halogen use is reduced to a minimum as well. This embodiment is particularly efficient.

A basic apparatus which carries out the method in accordance with the invention has a reaction vessel open on both ends, wherein the mercury-containing gases flow in through its first open end and flow out through its second open end. The flow can be created by thermal convection or by means of a blower. The reaction vessel is preferably pipe-shaped and the cross section can be arbitrary, for example circular or polygonal, e.g. rectangular. The reaction vessel has a supply or feed device for supplying at least one halogen or for placing the halogen into

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the reaction vessel.

In addition, the apparatus provides a separating device, in which the mercury halide(s) can be separated from the gas flow in the solid state, possibly together with further mercury compounds present in the gas flow. In the process, the mercury halide either (a) cools to a temperature below the evaporation temperature in the separating device or (b) flows at an already appropriate temperature into the separating device. When employing two or more halogens, cooling is performed to below the lowest evaporation temperature of the mercury halides used. For example, for mercury iodide and for mercury bromide the evaporation temperatures are approximately 354°C and 319°C, respectively. Thus, if both halogens are used, the temperature must be lower than 319°C.

In a preferred form of the first embodiment, a heat exchanger is used as the separating device. The advantage here is that by this step the energy balance is improved at the same time and in this way the efficiency of the entire system increased. In conventional installations the heat exchanger is primarily used in a manner known per se for the partial return of the process heat contained in the exhaust gas. For this purpose the heat exchanger has a large effective surface cooled by a fluid. The mercury halide(s) is (are) deposited thereon. Because of this, the effective flow cross section of the heat exchanger is increasingly reduced and as a consequence the flow resistance is increased. If it exceeds a threshold value, the heat exchanger must be cleaned. The time when a change is due is determined by means of two pressure probes, one in the inflow and the other in the outflow of the heat exchanger. With the flow speed being constant, the pressure difference between the two probes, i.e., the pressure loss caused by the heat exchanger, is a direct measurement of the flow resistance.

In the second embodiment, a filter is used as the separating

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unit, for example an electrostatic filter (E-filter) or a mechanical one. The advantage of the E-filter is a reduced pressure loss and consequently a reduced additional energy outlay. However, a mechanical filter, for example a conventional fibrous or textile filter, is cheaper.

To assure intimate mixing and reaction of mercury and halogens, a minimum distance must be maintained between the region where the halogen(s) enter(s) and where the corresponding mercury halides are separated from the gas flow. In individual cases this depends on the respective flow conditions and the type of admixture of the halogen(s). In a conventional exhaust gas installation the minimum distance is six times the hydraulic diameter of the exhaust gas conduit. It may be advantageous to assist admixing by suitable elements for the generation of flow eddies disposed in the interior of the reaction vessel.

The apparatus may have a second separating device. By means of this second separating device, halogen, which may be in excess after the reaction, is separated from the gas chamber, for example by means of an adsorption agent.

Preliminary tests with iodine have shown that aluminum chips are well suited as an adsorption medium. With dry gases it was possible to achieve an iodine absorption of 60 percent by weight, and with moist gases, such as is the general case with fossil-fired thermal processes, an iodine absorption of 40 percent by weight, at least, related to the adsorption medium. In comparison therewith, a clearly lesser iodine absorption was measured in the case of zinc chips (with dry gases, only 15 percent by weight). Aluminum chips, such as occur as waste products in machining operations, for example, are suitable. However, prior to their use as an adsorption agent, it is necessary to remove adhering lubricants which are often present.

In contrast, aluminum needles have not proven themselves

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useful because of the high apparent weight. Also, the air resistance of a corresponding filter is too great and the needles tend to adhere together, particularly with moist gases.

An apparatus for realizing the method in accordance with the invention with controlled halogen metering additionally has an Hg-measuring device for measuring the concentration of elemental mercury, as well as a control and regulating unit connected with the Hg-measuring device and acting on the feed device for the halogen. The measuring sensor of the Hg-measuring device is disposed at a distance downstream from the place where the halogen is added; the distance corresponds to at least six times the hydraulic diameter of the reaction vessel. This assures that at the place of measuring, the previously metered and supplied halogen has reacted essentially completely with the mercury and that therefore the actual remaining concentration of elemental mercury is measured.

The second separating device for separating excess halogen in the controlled apparatus may be omitted. The control unit preferably is adjusted in such a way that although the remaining concentration of mercury in the exhaust gas lies below a prescribed threshold value, it still lies above zero. In this way overdosing with halogen is impossible, i.e., the outflowing gas is sufficiently free of halogen even without an appropriate separating device.

DRAWINGS:

The invention will be explained below by means of some exemplary embodiments.

Fig. 1 is a schematic flow diagram of the method for the continuous separation of mercury from flowing gases in accordance with the invention. The additional method steps required for a controlled operation (second embodiment) are those framed by dashed lines.

Fig. 2 is schematic representation of an apparatus for

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executing the directed embodiment of the method of Fig. 1.

Fig. 3 is a schematic representation of an apparatus for executing the controlled embodiment of the method of Fig.1.

Fig. 4 is a schematic fragmentary view illustrating the separating device in form of a heat exchanger.

DETAILED DESCRIPTION:

Fig. 2 shows an apparatus 8 for performing the method of the first embodiment of the invention. The apparatus uses iodine as the reactant for the mercury and comprises the following components a tube-shaped reaction vessel 2 that is open at both ends and has a circular cross section, and a feed device 3-4-5 for introducing the iodine into the reaction vessel. The feed device includes at least one reservoir 3, which contains at least one halogen such as solid iodine and which is connected to a halogen holder 4, e.g. an evaporation trough, for charging the holder 4 with the halogen. The holder is displaceable (e.g., in a direction transverse to that of the gas flow) via a displacement unit 5 driven by a motor M. The apparatus also includes within the reaction vessel 2 a separation device 6, such as a fibrous or textile filter or an electrostatic filter 6a (Fig. 3), and an adsorption agent 7.

The feed device introduces at least one halogen into the reaction vessel 2, so that a predetermined amount of the appropriate halogen vapour is admixed with the gas flow. The evaporation holder 4 is introduced into vessel 2 by driving

the displacement unit 5, e.g. a supply belt, with the motor M. The reservoir 3 is external to the reaction vessel 2; the temperature of the halogen within the reservoir 3 may be approximately 30°C which is less than the temperature of the gas flow within the reaction vessel 2.

The reaction vessel 2 is placed into an exhaust air conduit of a glass melting installation (not shown) for mercury-containing fragments of light bulbs. Mercury-containing gases flow through it in the direction of the arrow, wherein the gases flow in through the first open end of the reaction vessel 2 and, after having passed through the adjoining reaction area 8, flow out through the second open end of the reaction vessel, essentially free of mercury.

The evaporation holder 4 of the feed device is located in the area of the first end of the reaction vessel 2 and is charged with solid iodine from the reservoir 3. The feeding rate of gaseous iodine to supply the gas flow corresponds to the evaporation rate of the iodine and can therefore be affected by the temperature of the evaporation holder 4 and by the iodine surface exposed inside the reaction vessel, i.e., by the manually preselectable length of the partial area of the evaporation holder 4 introduced into the reaction vessel 2. A heat exchanger 25 can be located upstream of the feed device if the temperature of the Hg-laden gases entering vessel 2 is excessively high.

Because of the gas flow, the individual gas components are mixed with each other relatively quickly in the adjoining reaction region 8 and the iodine combines with the

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mercury to form mercury iodide.

Within the reaction area 8, whose length L corresponds to approximately six times the diameter D of the reaction vessel 2, the reaction vessel 2 may have a simple and therefore cost-effective separation device 6 in the form of a fibrous or textile filter, which filters out the mercury iodide. The installation position of the apparatus 1 in relation to an exhaust gas conduit (not shown) and the connection position of the upstream heat exchanger 25, bring the mercury iodide flowing through the vessel 2 and then through the fibrous or textile filter 6 to a temperature below the evaporation temperature of the iodide (approximately 354°C). The downstream-connected adsorption agent 7 is made of aluminum chips at whose surfaces possible excess iodine is adsorbed.

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The particular advantage of this apparatus lies in its simple and cost-efficient design. However, the evaporation rate and therefore also the metering of the iodine is possibly affected by the temperature of the gas flowing around the evaporation trough 4. In that case it is not possible to use very small metered amounts and it may be necessary to accept overdosing.

In a particularly simply designed and therefore cost-effective embodiment, the supply or feed device consists of a wide-meshed metal net. It extends preferably over the entire cross section of the reaction vessel and is partially covered with solid iodine. The gases flow around the iodine through the uncovered mesh of the metal net, heat it and generate the desired vapor pressure. This embodiment is suitable for uses which do not require the exact control of the feed rate of halogen.

Fig. 3 schematically illustrates an apparatus 9 for carrying out the method in accordance with the second embodiment of the invention. The basic design is similar to that in Fig. 2. The flow direction has again been marked by arrows. The difference with respect to the embodiment of Fig. 2 lies in a changed feed device for the iodine, an additional regulating device and the omission of an adsorption agent.

The feed device uses a thermostat- controlled reservoir 11 of solid iodine 12, a suction line 13 provided with a blowback safety valve 14 and drying cartridge 15. The suction line 13 terminates in the reservoir 11 via a controllable pressure pump 16 and a continuous pressure line 17. A supply pipe 18 connects the reservoir 11 with the interior of the reaction vessel 10. The pressure pump 16 sucks ambient air through the drying cartridge 15 and the suction line 13 and introduces it via the pressure line 17 into the reservoir 11. The reservoir 11 is located inside a thermostat-controlled housing 19 which keeps the iodine 12 at a temperature of approximately 30°C. A suitably

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high vapor pressure of the iodine in the reservoir 11 is thereby created. The compressed air flows over the surface of the iodine 12 and is enriched with iodine vapor. The iodine-air mixture subsequently reaches the reaction vessel 10 through the supply pipe 18. The feed rate of the mixture can be controlled by means of controlling the flowing volume of the compressed air as well as the temperature and therefore the vapor pressure of the iodine 12.

The regulating device essentially includes an Hg-measuring device 20 for the selective measurement of the mercury concentration and a regulating device 21 connected therewith and controlling the controllable pressure pump 16. A measuring probe 22 of the Hg-measuring device 20 is disposed inside the reaction vessel 10 downstream of the supply pipe 18 at a distance A which approximately corresponds to six times the diameter D of the reaction vessel 10. A separation device 6 such as a fibrous or textile filter 6 (Fig. 2) or an electrostatic filter 6a (Fig. 3) is placed downstream of the measuring probe 22.

Preliminary tests have shown that this embodiment can react rapidly to fluctuations in the mercury content of the gas flow, so that with a suitable setting of the control 20, 21, no iodine overdosing occurs. For this reason an adsorption agent for iodine was omitted here, in contrast to Fig. 2.

Fig. 3 also shows, highly schematically, the separating device in form of an electrostatic precipitator 6a, connected to a voltage source 6b, the other terminal of which is connected to the vessel 10.

Fig. 4 shows, highly schematically, the separating device in form of a heat exchanger 26, located in the stream of gas flow, for use if the temperature of the gas and/or of the mercury halide goes above the evaporation temperature of the halogen being used. Heat recovered can be re-used. Cooling fluid is connected to couplings 27, 28.

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Various changes and modifications may be made, and any features described herein in connection with any one of the embodiments may be used with any of the others, within the scope of the inventive concept.

Example of an operative embodiment:

Inside diameter D of the reaction vessel 2, 10: 1.10 m temperature of gases at inlet end of reaction vessel 2, 10: 350°C gas flow rate through the reaction vessel: about 4.2 m^3/sec temperature of gases in region of introduction of halogen (Fig. 2: 4; Fig. 3: 18): 150°C rate of supply of halogen vapour from conduit 18 (Fig. 3) is such that the remaining concentration of mercury will be about 10 $\mu g/m^3$ temperature of gases with mercury halides at separator 6, 6a, 26: 140°C.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for continuously separating mercury from a gas flow, comprising the steps of:

adding a reactant to the gas flow to form a reaction product with the mercury and thereby separate the mercury from the gas flow,

wherein, in accordance with the invention,

the reactant is at least one halogen, reacting with the mercury in the gas to form a reaction product, the reaction product including at least one mercury halide;

converting the mercury halide into solid state; and

separating the mercury halide from the gas flow.

2. The method of claim 1, wherein the step of converting includes bringing the at least one mercury halide into contact with a surface having a temperature below the evaporation temperature of the at least one mercury halide so that the at least one mercury halide deposits on this surface.

3. The method of claim 1, wherein the reaction product includes a plurality of mercury halides; and

the step of converting includes cooling the mercury halides to a temperature below a temperature which is lower than the lowest one of the evaporation temperatures of the mercury halides.

4. The method of claim 1, wherein the separation of the mercury halide from the gas flow comprises electrostatic filtering.

5. The method of claim 1, wherein the separation of the mercury halide from the gas flow comprises mechanical filtering.

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6. The method of claim 1, further comprising the steps of selectively measuring the mercury concentration in the gas, and

readjusting the feed rate of the halogen as a function of the measured mercury concentration in such a way that a preselectable threshold value of the mercury concentration is set; and

wherein the steps of selectively measuring and readjusting are carried out after the reaction product is formed.

7. The method of claim 6, wherein the preselectable threshold value is less than 0.2 mg of mercury per m^3 of the gas.

8. The method of claim 1, further comprising the step of separating excess halogen from the gas flow.

9. The method of claim 8, wherein the step of separating excess halogen comprises an adsorption step.

10. The method of claim 1, wherein the at least one halogen includes an element selected from the group consisting of iodine and bromine.

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11. An apparatus for continuously separating mercury from a gas flow,

carrying out the method of claim 1,

comprising

a reaction vessel (2, 10) having a first open end through which the gas flows in and a second open end through which the gas flows out,

said reaction vessel (2, 10) having a feed device (3-4, 11-17) in the vicinity of said first open end, for supplying and placing at least one halogen into the reaction vessel, and

said reaction vessel further having a separating device (6, 6a, 26) in a vicinity of said second open end for separating mercury halide formed in the reaction vessel (2, 10) from the gas flow.

12. The apparatus of claim 11, wherein the separating device includes a heat exchanger (26).

13. The apparatus of claim 11, wherein the separating device includes an electrostatic filter (6a).

14. The apparatus of claim 11, wherein the separating device includes a mechanical filter (6), optionally a fibrous or textile filter.

15. The apparatus of claim 11, wherein the reaction vessel (2, 10) is substantially tubular in shape and the separating device and the feed device are disposed at a distance (A) from each other which corresponds to at least six times the hydraulic diameter (D) of the reaction vessel (2, 10).

16. The apparatus of claim 11, wherein said reaction vessel (2, 10) has an additional separating device (7) located in the

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vicinity of said second end, said additional separating device containing an adsorption agent for separating excess halogen from the gas flow.

17. The apparatus of claim 16, wherein the adsorption agent consists essentially of aluminum chips (7) when the halogen comprises essentially iodine.

18. The apparatus of claim 11, wherein the feed device includes

at least one halogen reservoir (3) containing the halogen, and means (4, 5) for receiving the halogen from said reservoir (3) and for controllable feeding said at least one halogen into the reaction vessel (2), so that a predetermined amount of the halogen vapor emitted from said at least one halogen is admixed with the gas flow, for reaction with the mercury within said gas flow.

19. The apparatus of claim 11, wherein the feed device has at least one reservoir (11) containing the at least one halogen (12);

means (13-17) for introducing pressurized gas into the reservoir (11); and

a halogen supply conduit (18) extending from the reservoir (11) into the reaction vessel (10) to provide a predetermined amount of the respective at least one halogen for admixture with the gas flow.

20. The apparatus of claim 19, wherein the pressurized gas introduction means includes a controlled element (16);

a halogen measuring device (20, 22) measuring the concentration of elemental mercury within the gas flow;

and a control circuit (21), responsive to the measuring

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device (20, 22) as a function of the concentration of elemental mercury, and controlling said controlled element (16) to thereby control the amount of halogen admixed to the gas flow.

21. The apparatus of claim 20, wherein the mercury measuring device (20, 22) has a measuring probe located in the the gas flow downstream of the supply conduit (18) where the at least one halogen is admixed into the gas, said probe being spaced from the conduit (18) by a distance (A) of at least six times the hydraulic diameter (D) of the reaction vessel (10).

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Page 767

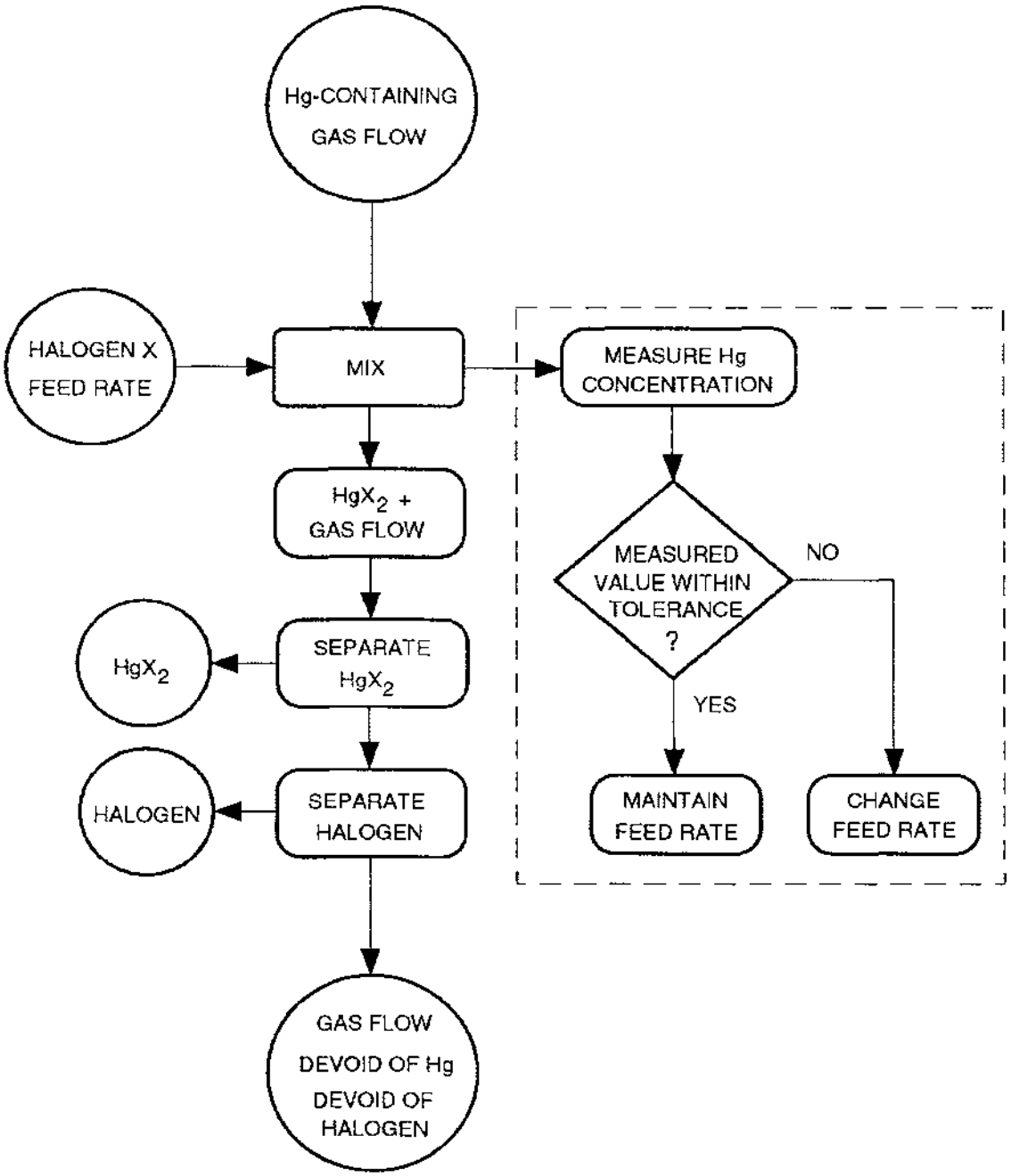


FIG. 1

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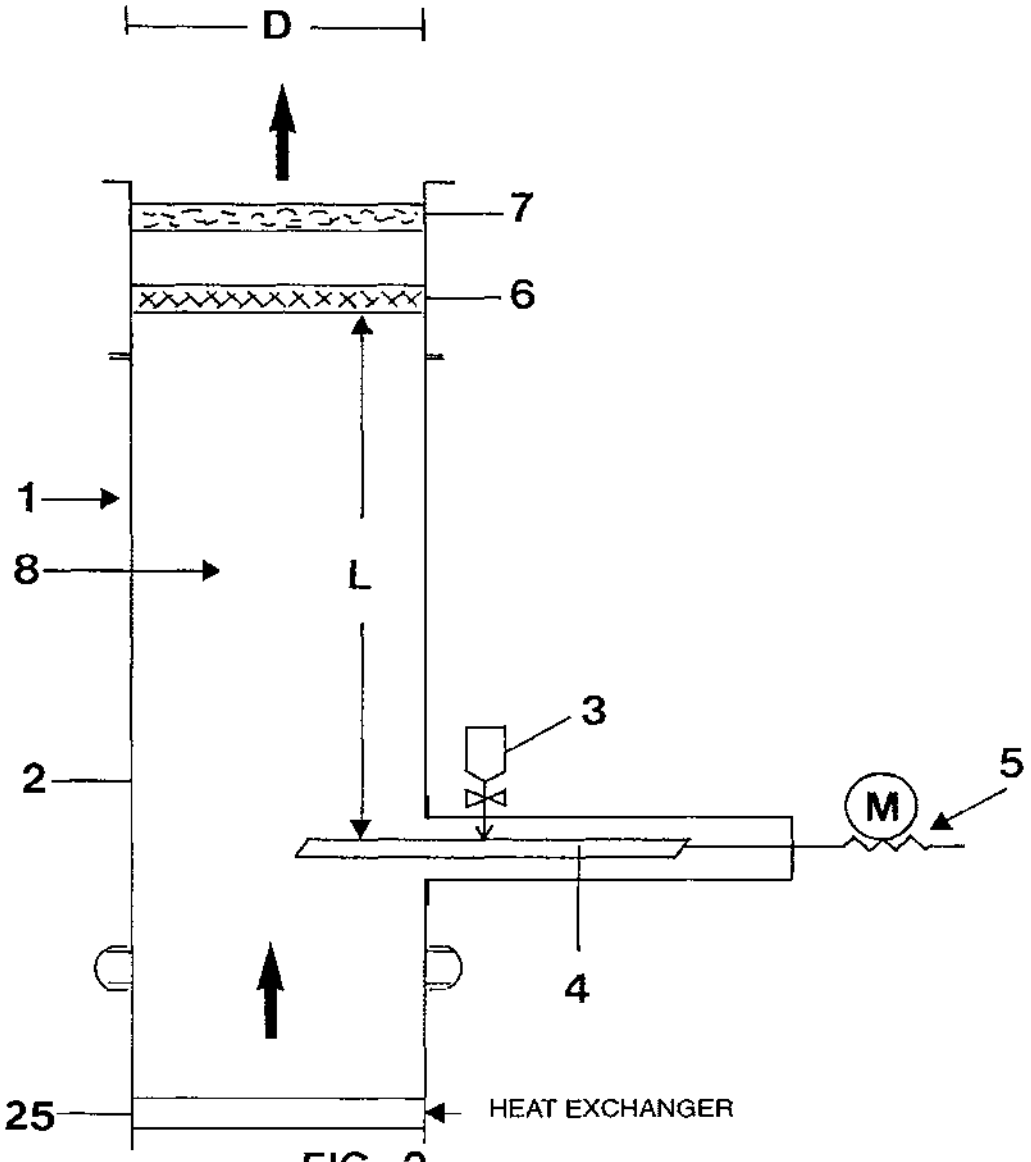


FIG. 2

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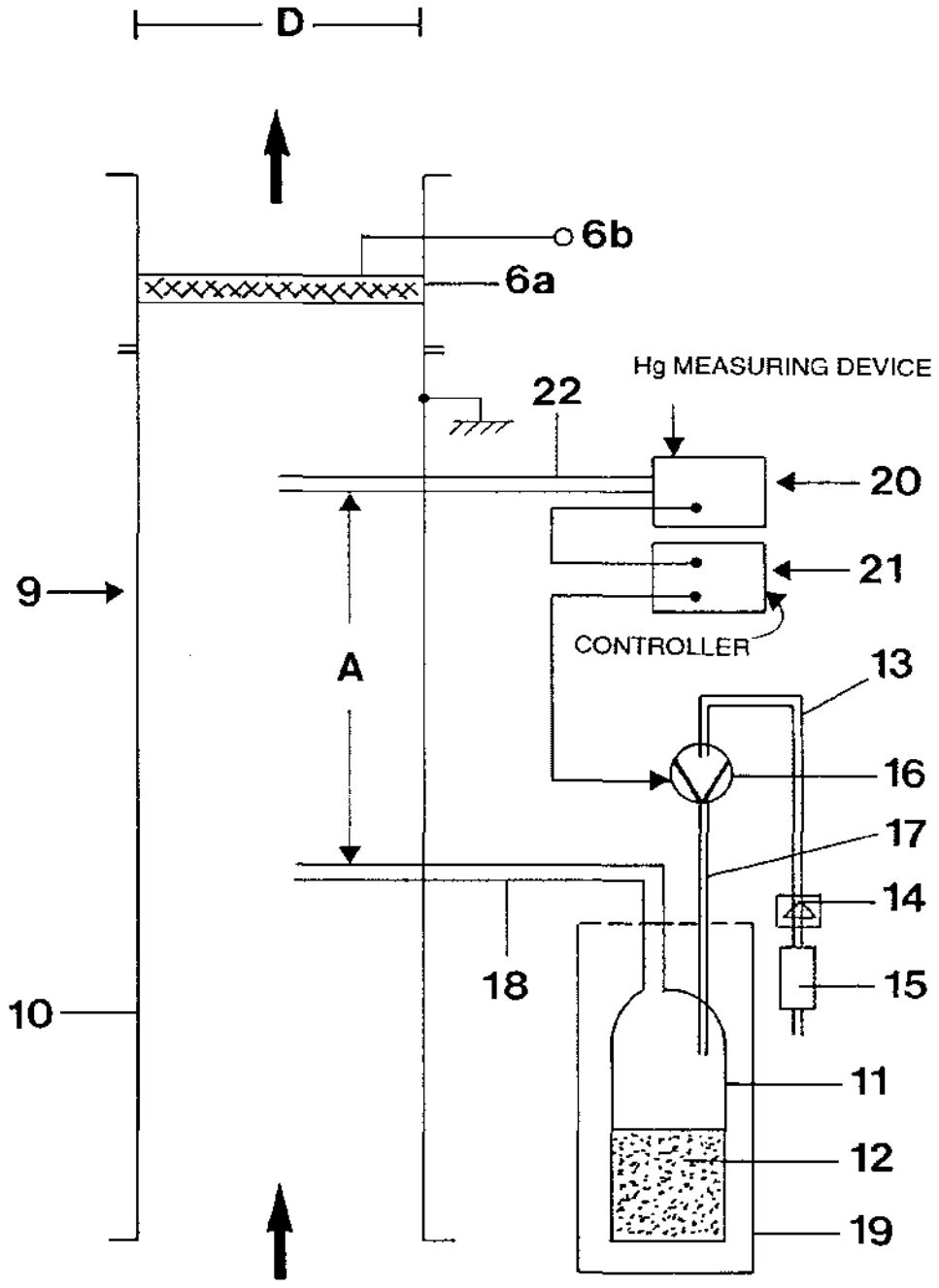


FIG. 3

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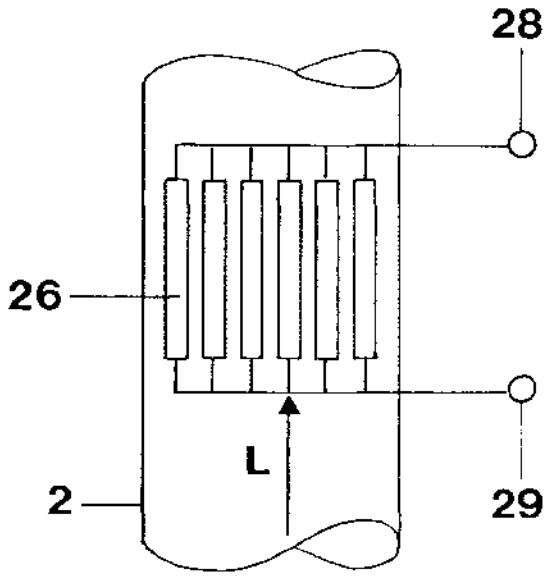


FIG. 4

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Un organisme d'Industrie Canada

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(54) METHODE DE REGENERATION DE MATERIAUX ABSORBANTS
(54) METHOD FOR THE REGENERATION OF SORBENT MATERIALS

(57)

The process of the present invention is directed to the use of sulfuric acid and/or an organic acid to regenerate spent sorbent from a metal recovery process. The sorbent can be activated carbon.

OPIC
Office de la propriété intellectuelle du Canada

CIPO
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(12) (19) (CA) Demande-Application

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(54) METHODE DE REGENERATION DE MATERIAUX ABSORBANTS

(54) METHOD FOR THE REGENERATION OF SORBENT MATERIALS

(57) The process of the present invention is directed to the use of sulfuric acid and/or an organic acid to regenerate spent sorbent from a metal recovery process. The sorbent can be activated carbon.

ABSTRACT

The process of the present invention is directed to the use of sulfuric acid and/or an organic acid to regenerate spent sorbent from a metal recovery process. The sorbent can be activated carbon.

METHOD FOR THE REGENERATION OF SORBENT MATERIALS

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part of U.S. Patent Application entitled "Method for the Regeneration of Activated Carbon" having Serial No. 09/454,584, filed December 6, 1999, which is incorporated herein by reference.

FIELD OF THE INVENTION

The invention relates generally to the regeneration of sorbents used for metal removal and specifically to the regeneration of carbonaceous sorbents.

BACKGROUND OF THE INVENTION

Cyanidation is commonly employed for the extraction of gold from its ores. In this process, the crushed ore is treated with a dilute solution of sodium cyanide (NaCN), and a small amount of lime (CaO) to maintain a pulp pH of >9. In the presence of oxygen, gold dissolves forming gold cyanide complex.

Recovery of the gold is typically accomplished by adsorbing the gold cyanide complex on activated carbon. The gold-loaded carbon is subjected to an elution process whereby the gold is eluted from the carbon by an eluant. The eluted (spent) carbon contains a low concentration of gold and has its gold adsorption capacity reduced. The spent carbon must therefore be regenerated before reuse.

Various regeneration methods have been proposed and practiced, but all of the methods are problematical in the areas of cost, regeneration efficiency and maintenance of the mechanical strength of the regenerated carbon. Therefore, development of an effective and economical regeneration method has been eagerly desired in the art.

Some conventional methods for the regeneration of activated carbon are: (a) a low temperature heating method comprising heating spent carbon at a temperature of 100-400°C. with steam or the like, (b) a high temperature heating method comprising heating spent carbon at a temperature of 400-1000°C., (c) a regeneration method using a high temperature inert gas, (d) a chemical regeneration method using acid or alkali, and (e) a wet oxidation method, etc.

In the gold mining industry using Carbon-in-Pulp (CIP) or Carbon-in-Leach (CIL) process, good carbon activity is important. Each mining operation has to match carbon activity with process requirements. When thermal carbon regeneration is used to regenerate spent carbon, it is a general rule that the higher the carbon activity the weaker the carbon and thus higher carbon losses in these processes. Therefore, it is common practice in the industry to thermally regenerate 50% or less of the total process carbon to save on regeneration costs and to reduce carbon losses.

Chemical methods of regenerating carbon achieve partial regeneration of the carbon and can reduce the frequency of thermal regeneration. It is employed to remove specific solvents and/or compounds from the carbon. The most common of the chemical methods are; (a) acid washing the spent carbon with hydrochloric or nitric acid solutions, and (b) caustic washing with sodium hydroxide solution to remove organic contaminants.

Acid washing using nitric or hydrochloric acid at room temperature after elution may restore carbon activity to some extent, but the improved carbon activity is small compared with that of thermal regeneration.

Carbon activation with sulfuric acid by impregnation and heating at 250°C for 4-6 hours was reported to improve adsorption of ammonia by active carbon fibers.

Davidson et al., U.S. Pat. No. 4,267,069, tried to increase carbon gold adsorption capacity by contacting the carbon with an aqueous copper salt solution at a pH less than 6 in the presence of carbonic acid, carbonate or bicarbonate.

Hanceford et al., U. S. Patent No. 4,407,725, tried to regenerate activated carbon with caustic wash and an optional periodic acid wash.

Lambert et al., U. S. Patent No. 5,087,374, tried to regenerate activated carbon used to purify wastewater with an aqueous bath containing a surface-active agent while ultrasonic vibration is applied to the aqueous bath.

Activated carbon used for liquid phase, however, cannot be regenerated unless it is subjected to the high temperature heating method, namely, a re-activation or a thermal regeneration method in which regeneration is effected under the same conditions as adopted for production of activated carbon. Further, regeneration conditions, such as the amount of steam

and the residence time in the regenerating furnace vary depending on amount and properties of activated carbons. Therefore, regeneration loss is increased by prolongation of the residence time, excessive incorporation of air and the like, and simultaneously, the mechanical strength is reduced in the regenerated activated carbon.

Furthermore, in some cases the exhaust gas from the regenerating furnace causes secondary air pollution. On the other hand, the chemical regeneration method in which high temperature heating is not conducted is advantageous in that the regeneration loss can be reduced, but the degree of regeneration is insufficient and lower than in the thermal regeneration method and both the waste coming from the spent carbon and the chemicals used for regeneration should be treated completely.

In summary, prior methods of regenerating activated carbon had disadvantages including the following:

- high energy costs of thermal regeneration;
- weakened carbon and generation of carbon fines;
- inadequate regeneration;
- expensive reagents;
- complex process; or
- expensive equipment.

Accordingly, the development of a regeneration method that will be able to overcome these defects involved in the conventional methods and to perform regeneration at an optimum regeneration rate with lessened regeneration loss has been highly demanded in the art.

As a result of intensive investigation made on regeneration of activated carbon, a novel activated carbon regeneration process has been discovered that satisfies the above-mentioned demands held in the art.

SUMMARY OF THE INVENTION

These and other needs are addressed by the process of the present invention. Generally, the present invention provides a methodology for regenerating a sorbent, such as activated carbon, for reuse in a metal adsorption, absorption, or entrapment process. As used herein, a

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"sorbent" refers to any substance that absorbs, adsorbs, or entraps another material. The methodology utilizes an organic acid and/or sulfuric acid during sorbent regeneration.

In one embodiment, the process includes the following steps:

(a) leaching (such as with a lixiviant) a metal-containing material to form a pregnant leach solution containing at least a portion of the metal,

(b) contacting the pregnant leach solution with a sorbent to form a loaded sorbent containing at least a portion of the metal dissolved in the pregnant leach solution,

(c) contacting the loaded sorbent with an eluant to form a loaded eluant containing at least a portion of the metal in or on the loaded sorbent and a spent sorbent,

(d) contacting the spent sorbent with an organic acid to form a regenerated sorbent, and

(e) recovering the metal from the loaded eluant.

The process is effective for a variety of metals and metal complexes. Preferably, the metal is a member of any one of Groups VIIIA, IB, or IIB, of the Periodic Table of the Elements. More preferably, the metal is gold, silver, platinum, copper, nickel, cobalt, mercury, and/or mixtures thereof. The metal can be complexed when in the pregnant leach solution, eluant, and/or in or on the loaded sorbent, with a variety of functional groups, including cyanide, thiocyanate, thiosulphate, and mixtures thereof. Typically, the metal is complexed with cyanide.

The lixiviant in step (a) can be any suitable material for dissolving the metal in the metal-containing material. Preferably, the lixiviant is one or more of cyanide, thiosulfate, thiourea, thiocyanate, and mixtures thereof. The leaching step can be performed by contacting the lixiviant with the material in a stirred or agitated or unstirred or unagitated vessel such as an open vessel or a closed vessel such as an autoclave or by applying the lixiviant to a pile or heap of the material or by applying the lixiviant to the material in situ.

The pregnant leach solution is contacted with the sorbent in any suitable vessel by any suitable technique. Preferably, the pregnant leach solution is contacted with the sorbent in an open or closed stirred or agitated or unstirred or unagitated vessel or by passing the pregnant leach solution through a bed of the sorbent in either a fluidized or fixed bed configuration.

The sorbent can be any suitable material for absorbing, adsorbing, or otherwise entrapping the metal. Preferably, the sorbent is organic and more preferably the sorbent is carbon (e.g., activated carbon), resins, and/or mixtures thereof.

As in the case of the pregnant leach solution, the eluant can be contacted with the loaded sorbent in any suitable vessel by any suitable technique. Preferably, the pregnant leach solution is contacted with the sorbent in a stirred or agitated or unstirred or unagitated vessel or by passing the pregnant leach solution through a bed of the sorbent in either a fluidized or fixed bed configuration.

The eluant can include any suitable eluting materials, such as ammonia, carbohydrates (a compound having the formula $C_x(H_2O)y$ where x and y are whole numbers), inert gases such as molecular nitrogen, a metal hydroxide (a compound containing one or more OH- groups), cyanides (a compound containing one or more -CN radicals), alcohols (an organic compound containing one or more hydroxyl groups), ketones (a compound in which the carbonyl group is attached to two alkyl groups), nitriles (an organic compound containing the -C=N grouping), acetone, cyanates (a salt of cyanic acid containing the radical - CNO), hydrazines, hydroxy acids, carboxylic acids, hydrocarbons (a compound consisting only of C and H), and mixtures thereof. The eluant typically includes a solvent for the eluting material. To avoid competing with the eluting material in displacement of the metal or metal complex from the sorbent, the solvent in a preferred embodiment preferably is a polar or substantially polar compound and the eluting material is nonpolar or substantially nonpolar. Preferred solvents include water, alcohols, and mixtures thereof. The preferred elution process is described in U.S. Patent Application Serial No. 09/372,025, filed August 13, 1999, and Serial No. 09/632,386, filed August 3, 2000, both of which are incorporated herein by this reference.

The regeneration of the spent sorbent is preferably performed using an inorganic acid such as a mineral acid (*e.g.*, sulfuric acid) and/or an organic acid such as a hydroxy acid (*e.g.*, an acid containing one or more hydroxy groups such as glycolic acid and/or lactic acid) and/or a carboxylic acid (*e.g.*, an acid containing one or more carboxylic groups such as acetic acid (or methanecarboxylic acid), formic acid, caproic acid, oxalic acid, cerotic acid, aromatic acids such as benzoic acid and salicylic acid, alicyclic acids such as abietic acid and chaulmoogric acid

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and/or amino acids), with organic acids particularly hydroxy acids being preferred and hydroxycarboxylic acids (particularly glycolic acid) being even more preferred. The operating parameters for the regeneration are important to realize the optimum degree of regeneration. The pH at which the regeneration is performed typically ranges from about pH 0.5 to about pH 3 and the temperature typically from about ambient to about 95°C. The concentration of the acid in the regeneration or acid wash solution contacted with the spent sorbent preferably ranges from about 3 to about 10 % weight. Regeneration can be performed in any suitable stirred or unstirred, agitated or unagitated vessel or by passing the acid wash solution through the spent sorbent in a fluidized or fixed bed configuration with the latter being preferred.

While not wishing to be bound by any theory, it is believed that the shorter chain organic acids, particularly glycolic acid, penetrate deeply into the sorbent matrix, particularly for organic sorbents such as carbonaceous sorbents. The depth of acid penetration into the matrix is believed to be dependent upon factors such as the shape of the acid molecule and the charge distribution on the molecule. The deep penetration of the acid inhibits removal and/or neutralization of the acid when the sorbent is water rinsed (after the regenerative acid wash) to remove excess acid. Unremoved (excess) acid will consume cyanide and other basic leaching agents when the sorbent is again contacted with the pregnant leach solution. During the contacting step (b) above, the unremoved acid in the sorbent matrix is believed to cause a lower pH to exist in or near the sorbent surface and/or pores than exists in the surrounding pregnant leach solution. The lower pH causes the metal to be more strongly attracted to the sorbent, thereby causing a higher amount of metal collection in the sorbent than has been previously realized with acids such as nitric acid and hydrochloric acid, which are not believed to penetrate deeply into the sorbent matrix. Organic sorbents such as activated carbon are believed to adsorb organic acids better than inorganic acids such as nitric acid and hydrochloric acid.

In one configuration that is particularly applicable to carbon-containing sorbents, a first portion of the spent carbon is contacted with the organic acid and a second portion of the spent carbon is contacted with sulfuric acid. The first portion of the spent carbon is subsequently thermally reactivated (*e.g.*, in a kiln or other suitable reactor or heater typically at a temperature ranging from about 600 to about 800°C) before being recycled to step (b) above and the second

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portion is not subsequently thermally reactivated before being recycled to step (c) above. The presence of an excessive amount of the sulfur atom in or on the second portion may cause oxidation and loss of carbon from carbon-containing sorbents during thermal reactivation.

The regenerated sorbent will typically contain some of the acid on the surface of or inside the pores of the sorbent. For example, regenerated carbon typically includes sulfuric acid and/or the organic acid adsorbed in a plurality of pores of the carbon.

The process, in one or more of its many embodiments, can have a number of advantages. Treating the activated carbon with a solution containing organic acids, particularly glycolic acid, can restore significant gold adsorption capacity to the spent sorbent. The process can have low capital and operating costs yet high regeneration efficiency and can maintain the mechanical strength of the regenerated sorbent. Although the process uses thermal reactivation techniques in one embodiment, other embodiments employ no thermal reactivation and are conducted at ambient to below about 100° temperatures, which lowers operating (energy) costs, is energy efficient, and avoids compromising the structural integrity of the carbon (thereby generating few if any carbon fines and reducing loss of carbon). Even when thermal reactivation is employed, the spent sorbent is typically heated to relatively low temperatures, which will not seriously compromise the mechanical strength of the regenerated sorbent. The regeneration techniques of the present invention can be fast and highly effective, thereby decreasing the risk of inadequate regeneration. The process can use relatively inexpensive reagents such as sulfuric acid and glycolic acid at optimum regeneration rates. The process can be relatively simple and can use relatively inexpensive equipment. In some embodiments, the regeneration process is performed *in situ*, thereby requiring less carbon handling. The process can be readily adapted to existing plants and infrastructures. The description and drawings below show additional objects and advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the major components and flow directions of a typical elution process incorporating the chemical regeneration process of the eluted (spent) carbon.

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FIG. 2 shows another embodiment of a regeneration process that may be employed with any suitable elution process;

FIG. 3 shows the plot of gold adsorption rate of carbons subjected to different carbon regeneration treatment.

FIG. 4 shows carbons that have been subjected to further gold adsorption cycles to increase its gold loading capacity.

DETAILED DESCRIPTION

General Discussion

Although the process embodiments discussed below specifically refer to the elution of gold from gold-loaded activated carbon generated from an extractive metallurgical process using a cyanide-containing lixiviant and a carbohydrate-containing eluant, it is to be understood that the processes are equally applicable for metals other than gold for eluants that do not contain carbohydrates, and for processes other than extractive metallurgy. For example, the processes can be used on other precious metals and base metals, to name but a few, and may be used to elute or remove metals/metal complexes from sorbents generated in water treatment and/or purification processes.

The acid wash solution can include any suitable mineral acid, such as nitric acid, hydrochloric acid, sulfuric acid, and/or an organic acid such as glycolic acid, and preferably has a pH ranging from about pH 0.1 to about pH 5 and more preferably from about pH 0.5 to about pH 2. The concentration of the acid in the acid wash solution preferably arranges from about 0.5 to about 25 vol.% and more preferably from about 3 to about 5 vol%.

While not wishing to be bound by any theory, it is believed that the eluting or blinding agent, in the presence of the acidic pH, is at most only weakly attracted to the sorbent, thereby causing a large fraction (typically at least about 90%) of the blinding agent into the solution from the sorbent surface. In other words, in the presence of a basic pH, the equilibrium between the blinding agent in the solution and the blinding agent on the surface of the sorbent strongly favors the attachment of the blinding agent to the sorbent surface. In contrast in the presence of an

acidic pH, the equilibrium between the dissolved blinding agent and the blinding agent on the surface of the sorbent strongly favors the dissolution (or hydrolysis) of the blinding agent.

The temperature of the acid wash typically ranges from about 80 to about 120°C.

After the solvent has been contacted with the acid wash for a time typically ranging from about 1 to about 2 hours, the regenerated sorbent can be rinsed with water to remove residual acid solution.

The sorbent can then be reused in a variety of known processes to remove dissolved metal/metal complexes from pregnant lixiviant solutions, industrial affluents, waste waters, etc., to form metal/metal complex loaded sorbent for use as the feed material in any elution processes including those described above.

Preferred Embodiment -- Description

A preferred process involving selected major operations is shown in FIG. 1. The gold-loaded carbon is soaked in the carbon elution column 10 at a temperature preferably ranging from about 80 to about 100°C and more preferably about 95°C with an organic acid wash solution 14 (having about 2% w/w organic acid) typically for at least about one hour. The acid wash solution 14 is drained out of the carbon column 10 and the carbon is thereafter neutralized with a suitable base 18 such as ammonia water (having about 2% w/w base) by passing the base 18 through the column 10. The gold-loaded carbon is then eluted in the column 10 with an eluant 22 in column 10 to strip the gold from the carbon and form gold-loaded eluant 26. After the elution process, the spent carbon in column 10 is washed with hot (e.g., about 95°C) acid wash solution 30. As will be appreciated, the organic acid wash solutions 14, 30 can be stored in the same vessel or in separate vessels. Heater 34 and heat exchanger 38 are used to heat the various solutions as desired.

The reagents used in this process, e.g., glycolic acid and ammonia solutions, may be reused if necessary by draining each solution back to their respective holding tank after each batch of carbon is treated by the solution. The solution can be made up to strength with fresh reagents before reuse.

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The pre-elution treatment using organic acid solution 14 and base 18 hastens the elution process as well as helps in the regeneration of the spent carbon in the post-elution treatment with organic acid solution 30.

Preferred Embodiment -- Operation

This part describes how my invention operates in reference to FIG. 1.

As indicated in FIG. 1, the gold-loaded carbon in column 10 is prepared for elution by washing with about 1.5 to 2 Bed Volumes (BV) of about 2% weight by weight ratio (w/w) organic acid wash solution 14 at about 95°C for one hour. The organic acid solution 14 is drained and the carbon is neutralized in column 10 with about 1.5 to 2 BV of 2% w/w base or basic solution 18 for another hour. This pre-elution treatment is meant to: (a) dissolve carbonate scale and reduce levels of calcium, magnesium, aluminum, and other metals, (b) reduce overall contaminant levels in the pores of the carbon, (c) hasten the elution process, and (d) help in the chemical regeneration of the carbon.

Eluant 22 is then contacted with the loaded carbon in column 10 to form the gold-loaded eluant 26. After the elution is at least substantially completed, the eluant 22 is drained from the carbon column _10. The spent carbon is then soaked in column 10 with about 2% w/w organic acid solution 30 at about 95°C to regenerate the spent carbon. The acid wash treatment is repeated at about 1.5 to 2 BV per hour for at least about one hour. The organic acid solution 30 is then drained from column 10 for reuse.

Alternative Embodiment

In-Situ Regeneration of Carbon-- Description

An additional embodiment conducts the alternating process of metal (e.g., gold) adsorption onto the sorbent and organic acid or sulfuric acid washing on the organic sorbent (e.g., carbon) to increase its metal loading capacity.

This embodiment relates to the regeneration of the organic sorbent outside of the elution process to increase gold loading capacity.

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In-Situ Regeneration of Carbon -- Operation

In the process of recovering the metal (particularly gold) from a pregnant leach solution (particularly a cyanide solution) using an organic sorbent or sulfuric acid (particularly activated carbon), the loading capacity of the sorbent carbon can be increased by the alternating process of metal adsorption and organic acid washing.

In one configuration, the operation involves the following steps:

- Drain the gold cyanide solution from the carbon column 10 after at least a portion of the gold (or other metal) is loaded onto the carbon;
- Rinse the gold loaded carbon with water to reduce the cyanide concentrations on the carbon;
- Drain the rinse water from the column 10 and soak the carbon in the organic acid solution in column 10;
- Drain the organic acid or sulfuric acid solution from column 10 and rinse with at least about one bed volume of water to reduce acidity; and
- Put the carbon column into operation (e.g., proceed with eluting the gold from the carbon and/or regenerating the sorbent).

The process can be done in any carbon vessels and at any temperatures. The organic or sulfuric acids and basic solutions preferably use the concentrations noted above. As will be appreciated, the process can be used for other metals and other sorbents described herein.

As will be appreciated, higher acid washing temperatures will achieve faster carbon regeneration.

In another embodiment of the present invention both a first acid wash solution containing an organic acid and a second acid wash solution containing an inorganic acid or a first acid wash solution containing a first organic acid and a second acid wash solution containing a second organic acid different from the first organic acid are employed to acid wash first and second portions, respectively, of the spent sorbent. One or both of the separately washed portions can be further subjected thermal reactivation to provide a high degree of sorbent activity.

In another embodiment of the present invention, glycolic acid, sulfuric acid, or both, is used to reactivate spent sorbent that may or may not undergo thermal regeneration before reuse.

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FIG. 2 shows this process according to this embodiment when the spent sorbent is generated using a less common continuous elution process. Most spent carbon is produced batchwise using a batch elution process; therefore the alternating batches of spent sorbent are thermally reactivated or not thermally reactivated. To further save on cost, spent sorbent that will be thermally regenerated is typically not acid washed. In this configuration, only spent sorbent that will not be thermally regenerated is acid washed with glycolic or sulfuric acid by a hot; preferably acid wash.

Referring to FIG. 2, the spent sorbent 100 in the embodiment using continuous elution is first divided 104 into separate first and second portions 108, 112 by any suitable technique and in any proportion. The first portion 108 is subjected to a first acid wash 116 using a first acid wash solution 120 containing an organic acid such as glycolic acid to form an acid washed first portion 124. The acid washed first portion 124 is then thermally reactivated 128 typically at a temperature ranging from about 600 to about 800°C in a suitable reactor or heater for a time ranging from about 30 to about 60 min. to form thermally reactivated first portion 132. The second portion 112 is acid washed 136 with a second acid wash solution 140 containing an inorganic acid such as sulfuric acid to form acid washed second portion 144. The acid washed second portion 144 and thermally reactivated first portion 132 are recombined 148 by suitable techniques to form the regenerated sorbent 152, which may be reused in the sorption/elution process.

As noted, Fig. 2 reflects a process utilizing the continuous elution of spent sorbent. For a batchwise process, Fig. 2 would be modified such that alternating batches of eluted or spent sorbent would constitute the first and second portions 108, 112. The dividing step 104 and recombining step 148 would be absent from the flow schematic in this embodiment as the first and second portions would be discrete from each other. As will be appreciated, when alternating batches of spent sorbent 100 are regenerated sequentially, a separating or dividing step would not be utilized. As noted, the first portion 108 may not be acid washed before thermal reactivation to reduce costs, and the first portion 108 and second portion 112 are sequentially and alternative respectively thermally reactivated and not thermally reactivated.

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Example 1

A method for comparing carbon activity was used to compare the following carbon regeneration treatments:

- Spent carbon, with no regeneration treatment;
- Spent carbon, acid washed at 95°C with nitric acid (HN03);
- Spent carbon, acid washed at 95°"C with hydrochloric acid (HC1);
- Spent carbon, acid washed at 95°C with glycolic acid (GA); and
- Spent carbon, with thermal regeneration.

Methodology involves presoaking one gram of carbon sample in "tailings" slurry for one hour before adding the carbon to one liter of standard gold cyanide solution containing about 10 ppm gold and buffered to pH 10. The purpose of presoaking the carbon in tailings slurry was to neutralize the "pH effect" of the acid treatment on carbon activity. The carbon samples were screened to minus 8-mesh and plus 10-mesh. At 15 minutes time intervals a small aliquots of test solution were removed to determine the remaining gold concentration. A plot is prepared for each carbon sample as shown in FIG. 3.

The data shows no significant improvement in carbon activity was attributed to the use of nitric and hydrochloric acid wash. Conventional acid washing allows for the removal of minerals containing calcium, magnesium and aluminum. The removal of these minerals proves helpful in improving thermal regeneration of the carbon.

On the other hand, washing with glycolic and sulfuric acid solution, significantly improved carbon activity. It is possible that thermal regeneration can be significantly reduced or eliminated in gold-adsorption processes such as CIL or CIP.

Maximum carbon regeneration was achieved by thermal regeneration at a price of high carbon losses. It is not always necessary to have a carbon that has very high activity. The gold adsorption process will dictate the required carbon activity for optimum operation.

Example 2

FIG. 4 and Table 1 show that alternating gold adsorption and glycolic acid washing of the loaded carbon can increase the gold loading capacity of the carbon. Two spent carbons, A

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and B, each initially containing 300-ppm gold were subjected further to four periods of gold adsorption. Carbon A was not acid washed between periods while Carbon B was acid washed with glycolic acid and water rinsed between periods.

The methodology involves two grams of carbon sample added to 100 mL of 127 ppm gold solution. The gold solution contains 0.5 g/L sodium cyanide and 1 g/L calcium hydroxide. The gold adsorption period was 2 hours and the acid washing period was 15 minutes with water rinse. After each gold adsorption period the gold solution was analyzed to determine the amount of gold adsorbed by the carbon. The carbon was then put into fresh gold solution for the next gold adsorption period.

Table 1

	Gold loading (ppm gold) in the Carbon after each cycle			
Cycles	1	2	3	4
Carbon A	3820	6010	7615	9135
Carbon B	3990	7635	10785	13530

While various embodiments of the present invention have been described in detail, it is apparent that further modifications and adaptations of the invention will occur to those skilled in the art. However, it is to be expressly understood that such modifications and adaptations are within the spirit and scope of the present invention.

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What is claimed is:

1. A process for recovering a metal from a metal-containing material, comprising:

(a) leaching the material to form a pregnant leach solution containing at least a portion of the metal,

(b) contacting the pregnant leach solution with a sorbent to form a loaded sorbent containing at least a portion of the metal,

(c) contacting the loaded sorbent with an eluant to form a loaded eluant containing at least a portion of the metal in the loaded sorbent and a spent sorbent,

(d) contacting the spent sorbent with an organic acid or sulfuric acid to form a regenerated sorbent, and

(e) recovering the metal from the loaded eluant.

2. The process of Claim 1, wherein the sorbent is at least one of carbon, and resin.

3. The process of Claim 1, wherein step (a) is performed by contacting a lixiviant with the material and wherein the lixiviant includes at least of cyanide, thiosulfate, thiourea, thiocyanate and mixtures thereof.

4. The process of Claim 1, wherein the eluant includes at least one of a carbohydrate, a hydroxide, a cyanide, an alcohol, a ketone, a nitrile, acetone, a cyanate, a hydrazine, a hydroxy acid, a carboxylic acid, a hydroxycarboxylic acid, a hydrocarbon, ammonia, and mixtures thereof.

5. The process of Claim 1, wherein the metal is a member of at least one of Groups VIIIA, IB, or IIB of the Periodic Table of the Elements.

6. The process of Claim 1, wherein the organic acid is one or more hydroxy acids.

7. The process of Claim 6, wherein the hydroxy acid is one or more hydroxycarboxylic acids.

8. The process of Claim 1, wherein the regenerated sorbent is reused in step (b).

9. The regenerated sorbent made in the process of Claim 1.

10. The metal recovered in the process of Claim 1.

11. A process for treating spent carbon, comprising contacting the spent carbon with an organic acid.

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