IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
Attorney Docket No.: 4820.007US4
Customer No.: 21186

PATENT APPLICATION TRANSMITTAL

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

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

X **CONTINUATION-IN-PART under 37 CFR 1.53(b) of prior Patent Application No. 15/295,594 comprising:**
- X Application Data Sheet (7 pgs).
- X Specification (47 pgs, including claims numbered 1 through 1 and a 1 page Abstract).
- X Formal Drawing(s) (6 sheets).
- X Copy of Declaration from prior application (6 sheets).
- X Certification and Request for Prioritized Examination (Track 1) (1 pg), including 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 $6,020.00**

The filing fee has been calculated below as follows:

	No. Filed	No. Extra	Rate	Fee
TOTAL CLAIMS	1- 20	0	x $100.00 =	$0.00
INDEPENDENT CLAIMS	1 - 3	0	x $460.00 =	$0.00
[]MULTIPLE DEPENDENT CLAIMS PRESENTED				$0.00
BASIC FEE				$300.00
SEARCH FEE				$660.00
EXAMINATION FEE				$760.00
DECLARATION LATE FILING FEE				$160.00
PRIORITIZED EXAMINATION (TRACK 1) FILING FEE				$4,000.00
PROCESSING FEE (TRACK 1)				$140.00
	No. of pages (75% for e-filing)	Extra sets of 50 pages	Rate	
APPLICATION SIZE FEE	(40 - 100) / 50	0	$400.00	$0.00
TOTAL				$6,020.00

Please charge any additional required 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 Number: 21186

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

Date of Deposit: May 14, 2018
This paper or fee is being filed on the date indicated above using the USPTO's electronic filing system EFS-Web, and is addressed to The Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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):	Unknown
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	Docket No.:	4820.007US4

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. **Original Application(Track One) – Prioritized Examination under § 1.102(e)(1)**

   i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

   ---OR---

   (b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

   ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

Signature /Nicholas P. Lanzatella/	Date May 14, 2018
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.

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	4820.007US4
	Application Number	Unknown
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 1: Edwin S. Olson

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Edwin	S.	Olson	

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

City	Grand Forks	State/Province	ND	Country of Residence	United States of America

Mailing Address of Inventor:

Address 1	223 Circle Hills Drive		
Address 2			
City	Grand Forks	State/Province	ND
Postal Code	58201	Country	United States of America

Inventor 2: Michael J. Holmes

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Michael	J.	Holmes	

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

City	Thompson	State/Province	ND	Country of Residence	United States of America

Mailing Address of Inventor:

Address 1	614 6th Avenue Northeast		
Address 2			
City	Thompson	State/Province	ND
Postal Code	58278	Country	United States of America

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	4820.007US4
	Application Number	Unknown
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.

Inventor 3: John H. Pavlish

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	John	H.	Pavlish	

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

City	East Grand Forks	State/Province	MN	Country of Residence	United States of America

Mailing Address of Inventor:

Address 1	42204 210th Street SW		
Address 2			
City	East Grand Forks	State/Province	MN
Postal Code	56721	Country	United States of America

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	21186
Email Address	request@slwip.com

Application Information:

Title of the Invention	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY		
Attorney Docket Number	4820.007US4	Small Entity Status Claimed ☐	
Application Type	Non-Provisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	6	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.007US4
	Application Number	Unknown
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). Entereither Customer Number or complete the Representative Name section below. If bothsections 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	21186		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.007US4
	Application Number	Unknown
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.

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-in-part of	15/295,594	2016-10-17
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
15/295,594	continuation of	14/102,896	2013-12-11
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
14/102,896	continuation of	12/429,058	2009-04-23
Prior Application Status	Abandoned		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing or 371(c) Date (YYYY-MM-DD)**
12/429,058	continuation-in-part 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	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	4820.007US4
	Application Number	Unknown
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	4820.007US4
	Application Number	Unknown
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		
Address 2			
City	Lewis Center	**State/Province**	OH
Country	United States of America	**Postal Code**	43035
Phone Number			
Email Address			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4820.007US4
	Application Number	Unknown
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)	2018-05-14
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**

SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 15/295,594, filed Oct. 17, 2016, which is a continuation of U.S. patent application Ser. No. 14/102,896 filed on Dec. 11, 2013 (now U.S. Pat. No. 9,468,886), which is a continuation of U.S. patent application Ser. No. 12/429,058 filed on Apr. 23, 2009 (now U.S. Pat. No. 8,652,235), which is a continuation-in-part of U.S. patent application Ser. No. 12/201,595 filed on Aug. 29, 2008 (abandoned), which is a divisional of U.S. patent application Ser. No. 11/209,163 filed on Aug. 22, 2005 (now U.S. Patent No. 7,435,286), which claims priority from provisional application Ser. No. 60/605,640 filed on Aug 30, 2004. The disclosures of U.S. patent application Ser. Nos. 14/102,896; 12/429,058; 12/201,595; 11/209,163; and 60/605,640 are hereby incorporated herein by reference to the extent appropriate.

BACKGROUND OF THE INVENTION

Technical Field of the Invention

[0002] The present invention relates to methods and materials for the removal of pollutants from flue gas or product gas from a gasification system. In particular, mercury is removed from gas streams generated during the burning or gasification of fossil fuels by highly reactive regenerable sorbents.

Background of the Invention

[0003] The combustion and gasification of fossil fuel such as coal generates flue gas that contains mercury and other trace elements that originate from the fuel. The release of the mercury (and other pollutants) to the environment must be controlled by use of sorbents, scrubbers, filters, precipitators, and other removal technologies. Mercury is initially present in the elemental form during combustion and gasification. In downstream process sections, such as in the ducts and stack of a combustion system, some of the elemental mercury is oxidized. The amount that is oxidized depends on the amount of acid gases present in the flue gas and other factors. Amounts of mercury vary with the fuel, but concentrations of mercury in the stream of flue gas from coal combustion are typically less than 5 parts per billion (ppb). Large coal combustion facilities such as electric utilities may emit a pound of mercury, or more, a day. Mercury removal applications include, without limitation, flue gas from coal (or other fossil fuel) combustion, waste incineration, product gas from gasification, as well as offgases from mineral processing, metal refining, retorting, cement manufacturing, chloralkali plants, dental facilities, and crematories.

Mercury Sorbent Technologies

[0004] Several types of mercury control methods for flue gas have been investigated, including injection of fine sorbent particles into a flue gas duct and passing the flue gas through a sorbent bed. Fine-particle injection sorbents include activated carbon, metal oxide sorbent, sodium sulfide particles, and basic silicate or oxide sorbents. When particle injection is employed, the mercury captured on the sorbent particles is removed from the gas stream in a particulate control device such as a baghouse or electrostatic precipitator (ESP) and collected along with ash particulate. The sulfide and basic silicate and oxide particles are effective only for the oxidized mercury, and the metal oxide sorbents exhibit slower capture kinetics than the carbon particles. Additionally, injection of fine carbon particles into the flue gas stream has been only partially successful in removing mercury, especially elemental mercury, where effective removal of only about 60% is attained for some applications with a FF (fabric filter) to collect carbon and ash. Even lower removal rates have been observed when an ESP is used to collect the carbon because the contact time of the carbon with the gas is very short.

[0005] A major problem with existing carbon injection systems is that the sorbent is relatively unreactive toward mercury. Consequently, these sorbents must be used in large amounts, at high sorbent-to-mercury ratios, to effectively capture the mercury. These sorbents tend to be relatively expensive and cannot be easily separated from the ash for regeneration and reuse. The collection of carbon in the ash also creates solid waste disposal problems, and the spent sorbent may contaminate the collected ash, preventing its use in various applications.

[0006] One solution has been to add an oxidative sorbent comprising an aluminosilicate material impregnated with a very heavy dosage of one or more oxidative metal halides plus activated carbon. For example, refer to Varma et al. (20070140940). However, the amounts of metal salts required for Hg oxidation are generally relatively large and expensive. Also, several of the salts that can be used in such a process are highly toxic. Although the metal salts are present for oxidation in this process, activated carbon is essential for getting adsorption of the Hg. As such, there is no synergistic role for the aluminosilicates as they appear to be only a support for the oxidizing salts.

[0007] Another approach has been the injection of aluminosilicate particulate such as bentonite, which contains neither oxidizing salts nor halogen complexes with a Lewis base site, and thus lacks the more powerful oxidizing capability of the said complexes as described in this application. For example, see U.S. Pat. No. 7,413,719. Additionally, the injection of an aluminosilicate (kaolin or metakaolin) containing calcium hypochlorite which thermally decomposes to form halogen is also

known. For example, see U.S. Patent Application No. 20030103882. Thus these and similar impregnated aluminosilicate technologies require time in flight at appropriate high temperatures to heat the impregnated salt(s) to generate an oxidation site. This clearly represents a kinetic barrier to activation in contrast to the extremely fast complexing reaction of the Lewis acid on the surface of the appropriate Lewis base sorbent described in the present patent. The kinetic barrier is only for heating up the calcium hypochlorite to decompose it to Cl atoms or molecules. Halogen (bimolecular or atomic) would complex with carbon or noncarbon at any lower temperature to form reactive oxidation sites. Also, halide would require a very high temp or strong acid to form reactive halogen or halogen complex.

[0008] Yet another approach is the injection of bentonite plus a metal sulfide and a metal salt, none of which is oxidizing to elemental mercury and would require a slow thermal activation step. For example, see U.S. Patent Application No. 20070119300.

[0009] The injection of halogen or halogen precursors in a hot zone, followed by contact with an alkaline material in a wet or dry scrubber is another approach known in the art. With such an approach, elemental mercury is claimed to be oxidized by the halogen to Hg(II) which is collected by the alkaline material in the scrubber. For example, see U.S. Pat. No 6,808,692 (Oehr), U.S. Pat. No. 3,849,267 (Hilgen), U.S. Pat. No. 5,435,980 (Felsvang), U.S. Pat. No. 6,375,909 (Dangtran), U.S. Patent Application No. 20020114749 (Cole), U.S. Pat. No. 6,638,485 (Iida), U.S. Patent Application No. 20030185718 (Sellakumar), U.S. Patent Application No. 20030147793 (Breen), and U.S. Pat. No. 6,878,358 (Vosteen). However, even though it is known to inject halogen forms at some stage of the combustion process, such a process does not utilize a complexing method on a sorbent surface for conducting the oxidation and capture. Further, the alkaline material is rapidly surface-coated by the large concentrations of acid gases, lowering its capacity for adsorption of Hg(II). It is also recognized that the halogen forms initially introduced or generated are far more reactive to the large concentrations of SO_2 and moisture in the flue gas, and so gas-phase reactions of the halogens with Hg are hindered. In contrast, the present invention takes advantage of the Lewis acid complexes that rapidly form on the sorbent surface to effect the Hg oxidation, rather than rely on gas phase reactions for oxidation. Thus HCl, HBr, SO_2Br, and other gas-phase products all festoon the surface and promote the activity of the sorbent by forming complexes with the sorbent to form a promoted sorbent.

[0010] Accordingly, there remains a need for more economical and effective mercury removal technology. This invention provides for cost-effective removal of pollutants, including mercury,

using sorbent enhancement additives and/or highly reactive sorbents, with contact times of seconds (or less), and that may be regenerated and reused.

SUMMARY

[0011] The various embodiments of the present invention overcome the various aspects of the deficiencies of the prior art and provide new and economical methods for the removal of mercury from the gases produced in the utilization of fossil fuels.

[0012] A halogen/halide-promoted sorbent is described that is highly effective for the removal of mercury from flue gas streams. The sorbent comprises any activated carbon and/or non-carbon compound, such as porous or vesicular felsic or basaltic materials, clay-based compounds, alkaline compounds, calcium hydroxide compounds, sodium acetate compounds, and/or bicarbonate compounds, or a combination thereof. Optional secondary components and alkali may be added to further increase reactivity and mercury capacity. Mercury removal efficiencies obtained exceed or match conventional methods with added benefits such as reduced costs. Optionally, the promoted sorbent can be regenerated and reused. Sorbent treatment and/or preparation methods are also described. Methods for in-flight preparation, introduction, and control of the sorbent, promoter and promoted sorbent into the mercury contaminated gas stream are described.

[0013] When a promoted or a non-promoted base sorbent reacts with elemental or oxidized mercury, a mercury/sorbent chemical composition is formed and, in the case of elemental mercury reacting with the promoted base sorbent, the mercury is oxidized. As discussed in further detail in other portions of the specification, the base sorbent may be either a carbon or a non-carbon material or a combination thereof. Additionally, the mercury/sorbent chemical composition may be comprised of covalent bonds, ionic bonds and/or chemical complexes between the promoted or non-promoted base sorbent and the oxidized mercury. The Lewis basic groups on the non-promoted base sorbent, or the non-promoted portions of a promoted base sorbent, are available for reaction with the Lewis acid groups of already existing oxidized mercury in the mercury containing gas. Thus, mercury may be removed from the mercury containing gas stream through the formation of multiple and various mercury/sorbent chemical compositions even within the same process. For example, multiple sites on a sorbent particulate can form multiple and various mercury/sorbent chemical compositions in the case where only a portion of the sites on the base sorbent particulate are promoted.

[0014] In some embodiments, a carbon and/or non-carbon promoted sorbent and/or a combination thereof is provided comprising a sorbent structure that has reacted with a promoter selected from the group consisting of halides, halogens, and combinations thereof, such that the reaction product is

effective for the removal of mercury from a gas stream. The carbon sorbent comprises reactive Lewis acid groups/sites; the non-carbon sorbent comprises reactive Lewis basic groups/sites.

[0015] In an embodiment, a promoted carbon and/or non-carbon sorbent is provided wherein the base sorbent is selected from the group consisting of carbon, activated carbon, porous or vesicular felsic and basaltic materials, clay-based compounds, alkaline compounds, calcium hydroxide compounds, sodium acetate compounds, and/or bicarbonate compounds, or a combination thereof, with an average particle size similar to that of fly ash produced from a thermal process (combustion or gasification) or greater than that of fly ash produced such that it is physically separable therefrom, and combinations thereof, and the promoter is selected from the group consisting of molecular halogens, Group V (CAS nomenclature is used throughout) halides, Group VI halides, hydrohalides, and combinations thereof. In an embodiment, the promoted sorbent (carbon, non-carbon, or their combination) may have a mass mean particle diameter such that it can be substantially separated by physical means from entrained ash in the gas stream from which mercury is to be removed. In an embodiment, the base sorbent (carbon, non-carbon, or their combination) may have a mass mean particle diameter greater than about 40 micrometers.

[0016] In another embodiment, the promoted sorbent comprises from about 1 to about 30 grams of promoter per 100 grams of base sorbent. Another embodiment further comprises an optional secondary component comprising a halogen or a hydrohalide such that the reactivity and mercury capacity of the promoted sorbent are enhanced.

[0017] In another embodiment, the concentration of the optional secondary component on the finished sorbent is within the range of from about 1 to about 15 wt% of the concentration of the promoter on the finished sorbent.

[0018] In another embodiment, an optional alkali component may preferably be added to provide a synergistic effect through combination of this alkali with the base sorbent.

[0019] In another embodiment, the optional secondary component is selected from the group consisting of Group V halides, Group VI halides, HI, HBr, HCl, and combinations thereof. In another embodiment, the promoter is substantially in vapor form when combined with the base sorbent. In another embodiment, the promoter is combined with an organic solvent prior to reaction with the base sorbent. In another embodiment, the promoter and optional secondary component are combined with the base sorbentsubstantially simultaneously. Another embodiment further comprises adding a mercury-stabilizing reagent selected from the group consisting of S, Se, H_2S, SO_2, H_2Se, SeO_2, CS_2, P_2S_5, and combinations thereof. Another embodiment further comprises adding an optional alkali component.

[0020] In an embodiment, a method is provided comprising providing a granular base sorbent and reacting the base sorbent with a promoter selected from the group consisting of halogens, halides, and combinations thereof, such that the reaction product comprises a promoted sorbent effective for removal of mercury from a gas stream. In a further embodiment, the reaction product comprises from about 1 to about 30 grams of promoter per 100 grams of base sorbent. In another embodiment the reaction product has an average particle-size distribution greater than the average size of entrained ash particles in the gas stream from which mercury is to be removed, such that the reaction product can be substantially removed from the entrained ash particles by physical means. In another embodiment, the reaction product has a mass mean particle diameter greater than about 40 micrometers.

[0021] In another embodiment, the promoter is selected from the group consisting of molecular halogens, hydrohalides, Group V halides, Group VI halides, and combinations thereof. In another embodiment, the promoter is in the gas phase when contacting the base sorbent (carbon, non-carbon, or their combination). In another embodiment, the promoter is in an organic solvent when contacting the base sorbent (carbon, non-carbon, or their combination).

[0022] In another embodiment, the promoter is selected from the group consisting of Br_2, a Group V bromide, a Group VI bromide, and combinations thereof.

[0023] In another embodiment, the method further comprises reacting the granular non-carbon with an optional secondary component comprising a halogen or a hydrohalide such that the reactivity and mercury capacity of the promoted sorbent are enhanced. In another embodiment, the promoter and optional secondary component are contacted simultaneously with the non-carbon base sorbent. In another embodiment, the method further comprises adding a mercury-stabilizing reagent selected from the group consisting of S, Se, H_2S, SO_2, H_2Se, SeO_2, CS_2, P_2S_5, and combinations thereof. In an embodiment, a method is provided for control of mercury in a flue gas with substantially lower sorbent requirements. Through enhanced sorbent reactivity, mercury removal per gram of sorbent is increased, thereby decreasing the capital and operating costs by decreasing sorbent requirements.

[0024] In an embodiment, the promoted sorbent is introduced by direct injection into the flue gas stream. In another embodiment, the base sorbent is promoted within the flue gas stream

[0025] In an embodiment, a method is provided for reducing mercury in flue gas comprising providing a base sorbent, either by injection or in situ creation, into a mercury-containing flue gas stream, collecting greater than 70 wt% of the mercury in the flue gas on the promoted sorbent to produce a cleaned flue gas, and substantially recovering the promoted sorbent from the cleaned flue gas. In embodiments where less than 70 wt% mercury removal is desired, the required removal is

attained using less base sorbent as would be required with standard base sorbent. In a further embodiment, the method further comprises monitoring the mercury content of the clean flue gas, regenerating the recovered promoted sorbent, and using the monitored mercury content of the cleaned flue gas to control the rate of base sorbent and promoter. In another embodiment the injected promoted sorbent is prepared in-flight by reacting a base sorbent (carbon, non-carbon, or their combination) and a promoter within a pneumatic transport line from which the reaction product is injected to the mercury-containing flue gas stream.

[0026] In another embodiment, the promoter is selected from the group consisting of molecular halogens, halides, and combinations thereof. In another embodiment, the promoter is reacted in the gas phase or as a vapor. In another embodiment, the promoter is added at from about 1 to about 30 grams per 100 grams of the base sorbent (carbon, non-carbon, or their combination).

[0027] In another embodiment, the injected promoted sorbent is prepared in-flight by reacting a base sorbent (carbon, non-carbon, or their combination), a promoter, and an optional secondary component to enhance the reactivity and capacity of the promoted sorbent within a pneumatic transport line from which the reaction product is injected to the mercury-containing flue gas stream.

[0028] In another embodiment, the optional secondary component is selected from the group consisting of iodine, hydrohalides, Group V halides, Group VI halides, and combinations thereof. In another embodiment, the optional secondary component is added at from about 1 to about 15 wt% of the promoter content. In another embodiment, the method further comprises adding to the promoted sorbent a mercury-stabilizing reagent selected from the group consisting of S, Se, H_2S, SO_2, H_2Se, SeO_2, CS_2, P_2S_5, and combinations thereof.

[0029] In an embodiment, the method further comprises coinjecting an optional alkaline material, including without limitation alkaline and alkaline-earth components, to improve the efficiency of mercury capture by capturing oxidized mercury and/or capturing gaseous components that might otherwise reduce promoted sorbent capacity. In another embodiment, the optional alkaline material may preferably comprise calcium oxide, sodium carbonate, and the like, as are known in the art.

[0030] In another embodiment, the method further comprises using the monitored mercury content of the cleaned flue gas to control the composition of the promoted sorbent. In another embodiment, the promoted sorbent is prepared in-flight by reacting a base sorbent (carbon, non-carbon, or their combination) and a promoter within the flue gas stream or in a transport line from which the reaction product is injected to the mercury-containing flue gas stream, wherein the promoter is selected from the group consisting of molecular halogens, halides, and combinations thereof, wherein the promoter is reacted in the gas phase or as a vapor, wherein the promoter is added at from about 1 to about 30

grams per 100 grams of the base sorbent (carbon, non-carbon, or their combination), wherein the rate at which the promoter is added and the rate of promoted sorbent injection are determined by a digital computer based, at least in part, on the monitored mercury content of the cleaned flue gas.

[0031] In an embodiment, a method for reducing the mercury content of a mercury and ash-containing gas stream is provided wherein particulate carbon and/or non-carbon promoted sorbent with a mass mean size greater than 40 μm is injected into the gas stream, mercury is removed from the gas by the promoted sorbent particles, the promoted sorbent particles are separated from the ash particles on the basis of size, and the promoted sorbent particles are reinjected to the gas stream. In another embodiment, the mercury-containing promoted sorbent particles are regenerated to remove some or substantially all of the mercury. In another embodiment, an alkaline component is coinjected into the gas stream. In another embodiment, the promoted sorbent may further comprise a promoter. The promoter may preferably comprise a halide, a halogen, or both.

[0032] In an embodiment, a method for reducing mercury in a mercury-containing gas to a desired level is disclosed. The method comprises reacting a carbon base sorbent with at least one promoter selected from the group consisting of molecular halogens, halides, and combinations thereof to produce a promoted carbon sorbent; allowing said promoted carbon sorbent to interact with a mercury-containing gas to capture mercury in the mercury-containing gas on the promoted sorbent to produce a cleaned gas; and monitoring the mercury content of the cleaned gas. In some embodiments, the carbon base sorbent and the promoter are introduced into the mercury-containing gas at the same location or at separate locations. In some embodiments, the carbon base sorbent or promoter or combination thereof is introduced into the mercury-containing gas at one or more locations. In an embodiment, the rate at which the carbon base sorbent is introduced or the rate at which the promoter is introduced or combination thereof is adjusted according to the monitored mercury content of the cleaned gas so that the mercury content of the cleaned gas is maintained at substantially the desired level with minimal operating cost.

[0033] In a further emobodiment, the method comprises reacting a non-carbon base sorbent with at least one promoter selected from the group consisting of molecular halogens, halides, and combinations thereof to produce a promoted non-carbon sorbent; allowing said promoted non-carbon sorbent to interact with a mercury-containing gas to capture mercury in the mercury-containing gas on the promoted sorbent to produce a cleaned gas; and monitoring the mercury content of the cleaned gas. In some embodiments, the non-carbon base sorbent and the promoter are introduced into the mercury-containing gas at the same location or at separate locations. In some embodiments, the non-

carbon base sorbent or promoter or combination thereof is introduced into the mercury-containing gas at one or more locations. In an embodiment, the rate at which the non-carbon base sorbent is introduced or the rate at which the promoter is introduced or combination thereof is adjusted according to the monitored mercury content of the cleaned gas so that the mercury content of the cleaned gas is maintained at substantially the desired level with minimal operating cost.

[0034] In a further embodiment, a method for reducing mercury in a mercury-containing gas to a desired level is presented. The method comprises reacting a base sorbent with at least one promoter selected from the group consisting of molecular halogens, halides, and combinations thereof to produce a promoted sorbent, wherein said base sorbent is selected from the group consisting of a non-carbon material, a carbon material, and combination thereof; allowing said promoted sorbent to interact with a mercury-containing gas to capture mercury in the mercury-containing gas on the promoted sorbent to produce a cleaned gas; and monitoring the mercury content of the cleaned gas.

[0035] In some embodiments, the base sorbent and the promoter are introduced into the mercury-containing gas at the same location or at separate locations. In some embodiments, the base sorbent or promoter or combination thereof is introduced into the mercury-containing gas at one or more locations. In some embodiments, introducing the base sorbent and the promoter comprises injecting the base sorbent and the promoter into the mercury-containing gas. In some embodiments, the promoter is introduced into the mercury-containing gas upstream of the introduction of the base sorbent. In some embodiments, the promoter is introduced upstream of a boiler or a combustion chamber. In an embodiment, the rate at which the base sorbent is introduced or the rate at which the promoter is introduced or combination thereof is adjusted according to the monitored mercury content of the cleaned gas so that the mercury content of the cleaned gas is maintained at substantially the desired level with minimal operating cost.

[0036] In an embodiment, the base sorbent for the promoted sorbent is selected from the group consisting of carbon, activated carbon, porous felsic materials, vesicular felsic materials, porous basaltic materials, vesicular basaltic materials, clay-based compounds, alkaline compounds, calcium hydroxide compounds, sodium acetate compounds, bicarbonate compounds, and combinations thereof. In embodiments, the non-carbon material comprises Lewis basic groups and the carbon material comprises Lewis acid groups. In some cases, the non-carbon material comprises amorphous forms of tectosilicates comprising nanoscale cavities lined with Lewis basic oxygen associated with alkaline-earth metals. The alkaline-earth metals comprise Group I and Group II alkaline-earth metals. In some other cases, the non-carbon material comprises amorphous forms of phyllosilicates comprising nanoscale cavities lined with Lewis basic oxygen.

[0037] In an embodiment, the promoted sorbent comprises metastable complexes formed between the promoter of this disclosure and inorganic species on the non-carbon base sorbent. In some embodiments, the inorganic species is selected from the group consisting of sodium compounds, calcium compounds, magnesium compounds, aluminum compounds, iron compounds, and combinations thereof. In an embodiment, the promoted sorbent comprises metastable complexes formed between the promoter of this disclosure and metal-oxygen-metal structures on the non-carbon base sorbent. In some embodiments, the promoter after being complexed with the metal-oxygen-metal structures is in the form selected from the group consisting of a dihalogen group, a halogen atom, a hydrohalogen group, a Group V halide, a Group VI halide, and combinations thereof. In an embodiment, the promoted sorbent comprises activated Lewis basic groups or activated Lewis acid groups or combination thereof. In some embodiments, the interaction between promoted sorbent and said mercury-containing gas stream comprises mercury diffusing from the gas phase onto said promoted sorbent surface; and reacting with the activated Lewis basic groups or activated Lewis acid groups or combination thereof to cause chemisorption on the promoted sorbent surface.

[0038] In an embodiment, the method for reducing mercury in a mercury-containing gas to a desired level further comprises pretreating the base sorbent to increase the number of Lewis basic groups or Lewis acid groups or combination thereof. In some cases, the pretreating methods comprise chemical treatment, thermal treatment, vacuum treatment, and combinations thereof. In some embodiments, chemical treatment comprises acid treatment and alkaline treatment. In an embodiment, the method for reducing mercury in a mercury-containing gas to a desired level further comprises introducing an alkali component into the mercury-containing gas.

[0039] As will be described in more detail below, the present invention thus provides several advantages over previously known techniques, including significantly more effective and economical mercury sorbents for effluent gases, advantageously applicable to treating gas streams from combustion and gasification systems.

[0040] The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter that form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and specific embodiments disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] For a more detailed description of the preferred embodiments of the present invention, reference will now be made to the accompanying drawings.

[0042] FIG. 1 schematically illustrates methods for preparation of promoted carbon and/or non-carbon sorbents in accordance with the present invention.

[0043] FIG. 2 illustrates a proposed mechanistic model of the chemical reactions resulting in the oxidation and capture of mercury.

[0044] FIG. 3 schematically illustrates preparation of promoted carbon and/or non-carbon sorbents and processes for flue gas mercury reduction in flue gases and/or product gases from a gasification system in accordance with the present invention, including in-flight preparation of promoted carbon and/or non-carbon sorbent.

[0045] FIG. 4 illustrates a mechanism for promotion of metal oxide base sorbent via formation of a reactive halogen complex sorbent and subsequent capture of elemental mercury on the promoted sorbent.

[0046] FIG. 5A schematically illustrates an exemplary process flow diagram for in-flight preparation of a promoted carbon and/or non-carbon sorbent.

[0047] FIG. 5B schematically illustrates an exemplary process flow diagram for in-flight preparation of a promoted carbon and/or non-carbon sorbent.

[0048] FIG. 6 is a block diagram illustrating the use of the invention in a coal fueled facility.

DETAILED DESCRIPTION

[0049] Herein will be described in detail specific preferred embodiments of the present invention, with the understanding that the present disclosure is to be considered an exemplification of the principles of the invention and is not intended to limit the invention to that illustrated and described herein. The present invention is susceptible to preferred embodiments of different forms or order and should not be interpreted to be limited to the specifically expressed methods or compositions

contained herein. In particular, various preferred embodiments of the present invention provide a number of different configurations and applications of the inventive method, compositions, and their uses.

[0050] The present invention provides a cost-effective way to capture pollutants by utilizing exceptionally reactive halogen/halide-promoted sorbents using a bromide (or other halogen/halide) treatment of the promoted sorbent, that capture mercury via mercury–sorbent surface reactions, at very short contact times of seconds or less. The reactivity of the promoted sorbent toward the pollutants (i.e., mercury) is greatly enhanced, and the sorption capacity can be regenerated; i.e., the promoted sorbent may be regenerated, recycled and/or reused.

[0051] The treated base sorbents (carbon, non-carbon, or their combination), treatment techniques, and optional additives discussed herein have applicability to mercury control from the product or effluent gas or gases from gasification systems, syngas generators, and other mercury-containing gas streams, in addition to the flue gas from combustion systems. Thus it should be understood that the terms combustion system and flue gas as used throughout this description may apply equally to gasification systems and syngas or fuel gas, as will be understood by those skilled in the art.

[0052] Hereinafter the disclosure may at times discuss the use of carbon base sorbents in further details; however the use of non-carbon base sorbents and a combination of carbon and non-carbon base sorbents is also contemplated to at least the same degree as carbon base sorbents.

[0053] Referring now to FIG. 1, there is shown a block flow diagram illustrating some preferred embodiments of the process of the present invention to prepare promoted sorbents useful for mercury capture in a mercury containing gas, such as a flue gas and/or product gas from gasification system streams. In a preferred embodiment illustrated by path 10-20, block 10 illustrates providing a base sorbent while block 20 illustrates adding a halogen or halide promoter that reacts with the base sorbent to produce a product-promoted sorbent. In embodiments where the halogen or halide is added, for example, as a vapor, no further steps may be necessary. In embodiments where the halogen or halide is added in, for example, a solvent, it may be desirable to employ solvent removal as illustrated by block 20A to produce a product-promoted sorbent suitable for injection.

[0054] Referring still to FIG. 1, another preferred embodiment of the process of the present invention is illustrated by path 10-20-30, comprising providing a base sorbent as shown by block 10, adding a halogen or halide promoter that reacts with the base sorbent, illustrated at block 20, and adding a secondary component illustrated at block 30 that reacts with the result of block 20 to produce a product-promoted sorbent. In embodiments where both the halogen or halide promoter and the secondary component are added, for example, as a vapor, no further steps may be necessary.

In embodiments where the halogen or halide promoter and/or secondary component are added in, for example, a solvent, it may be desirable to employ solvent removal as illustrated by block 30A to produce a product-promoted sorbent suitable for injection.

[0055] Referring still to FIG. 1, another preferred embodiment of the process of the present invention is illustrated by path 10-40, comprising providing a base sorbent as illustrated at block 10 and adding a halogen or halide promoter and a secondary component to the base sorbent together, with which they react to produce a product-promoted sorbent as illustrated by block 40. As above, in embodiments where vapor additions are made to the base sorbent, no further steps may be desired. In embodiments where one or more components are added in solvent, a solvent removal step may be provided as illustrated by block 40A to produce a product-promoted sorbent suitable for injection.

[0056] Referring still to FIG. 1, another preferred embodiment of the process of the present invention is illustrated by path 10-50 in combination with path 20-50. In this embodiment, a base sorbent as illustrated by block 10 is introduced to the mercury containing gas as illustrated by block 50 while a halogen or halide promoter as illustrated by block 20 is introduced to the mercury containing gas stream. Thus the base sorbent and promoter react at block 50 to produce a product-promoted sorbent. In a similar manner, a secondary component as illustrated by block 30 may be added to the halogen or halide promoter as illustrated by block 20 and introduced into the mercury containing gas as illustrated by block 50. In embodiments where both the halogen or halide promoter and secondary component are added, for example, by vapor, no further steps may be taken. In embodiments where the halogen or halide and/or secondary component are added in, for example, a solvent, it may be desirable to employ solvent removal as illustrated by block 20A and/or block 30A.

[0057] Referring still to FIG. 1, also illustrated are preferred embodiments in which, as illustrated by block 50, a mercury containing gas stream is treated with product-promoted carbon sorbent prepared as described above.

[0058] In some preferred embodiments, the carbon base sorbent provided may preferably be any of several types, as understood by those skilled in the art. For example, the carbon base sorbent may include powdered activated carbon, granular activated carbon, carbon black, unburned carbon, carbon fiber, carbon honeycomb or plate structure, aerogel carbon film, pyrolysis char, regenerated activated carbon from product-promoted carbon sorbent, or other types as known in the art.

[0059] In some preferred embodiments, the carbon base sorbent provided may preferably have a mass mean particle size greater than the fly ash in a mercury containing gas, such as a flue gas stream, to be treated.

[0060] In some preferred embodiments, the carbon base sorbent provided may preferably have a mass mean particle diameter preferably greater than 40 micrometers, more preferably greater than 60 micrometers, or a particle-size distribution greater than that of the fly ash or entrained ash in a flue gas stream, or other mercury containing gas, to be treated, such that the activated carbon and ash can be separated by physical means.

[0061] In some preferred embodiments, the halogen or halide promoter that is added to, and reacts with, the carbon base sorbent may preferably comprise, by way of illustration and not limitation, a molecular halogen in vapor or gaseous form, a molecular halogen in an organic solvent, a Group V or Group VI halide, such as PBr_3 or SCl_2, respectively, in vapor, liquid, or solution form (though not in an aqueous solvent).

[0062] Embodiments are also provided in which the organic solvent may preferably comprise a chlorinated hydrocarbon, such as dichloromethane, a hydrocarbon solvent, including for example, petroleum ether, ligroin, pentane, hexane, toluene, and benzene, carbon disulfide, a waste solvent, an ether, a recycled solvent, a supercritical solvent, such as supercritical CO_2, water (though not in the case of a Group V or Group VI halide), and others as will be apparent to those of skill in the art.

[0063] Referring now to FIG. 4, a theory is illustrated developed from scientific evidence to explain the nature of the promoting compounds. For example, as illustrated in FIG. 4, a molecular bromine molecule forms a complex with the surface of the base sorbent comprising a high surface area form of a metal oxide. Complexing with bromine can occur at surface and defect sites on the surface of the glassy amorphous tectosilicates by association with the Lewis basic oxygen lining the interstitial cavities and the alkali actions on the surface. Molecular hydrogen bromide or an electrophilic or Lewis acid bromine compound react to form a similar structure. The precedence for this promotion of a metal oxide surface complex with an acidic species is described in a paper by Stark and Klabunde (Klabunde, K.J. Chem. Mater. 1996, 8, 1913-1918) who showed addition of acids, HCl, SO_3, and NO, to a MgO surface to form a surface complex. In U.S. Pat. No. 6,517,423 to Koper et al. the described surface complexes were active for destroying biological agents and toxins. As shown in FIG. 4, addition of halogens to a metal oxide surface (A) can form a complex that could be described as a bromide-oxybromide species (B), in which electrophilic reactivity is maintained, owing to the formation of positive charges on the surface. The electrophilic complex formed on the metal oxide base sorbent comprises an active site for oxidation of elemental mercury. Addition of mercury to the complex results in formation of a mercury oxygen bond and, simultaneously, a

mercury bromine bond as shown in complex C in FIG. 4. Thus the final structure is a stable oxidized Hg form (D) described as a metaloxymercuric bromide.

[0064] In summary, it has now been found that the formation of the new bromide complex with the metal oxide surface increases the surface reactivity toward mercury and other pollutants. Additionally, the resulting bromide compound is uniquely suited to facilitate oxidation of the mercury. The effectiveness of the oxidation apparently results from the promotion effect of the halide, exerted on the developing positive charge on the mercury during the oxidation, known in the chemical art as a specific catalytic effect. Thus as the mercury electrons are drawn toward the positive surface oxygen, the halide anion electrons are pushing in from the other side, stabilizing the positive charge developing on the mercury and lowering the energy requirement for the oxidation process. Bromide is especially reactive, owing to the highly polarizable electrons in the outer 4p orbitals of the ion. Thus adding HBr or Br_2 to the appropriate metal oxide forms a similar surface bromide complex, in which the positive oxygen oxidizes the mercury with the assistance of the bromide ion.

[0065] In embodiments, a non-carbon base sorbent with Lewis basic sites/groups comprising metal-oxygen-metal structures is activated by a promoter of this disclosure, forming a promoted sorbent. The promoter and the metal-oxygen-metal structures of the non-carbon base sorbent form metastable complexes, which are responsible for mercury capture via chemisorption. For example, metastable complexes may form between a halogen promoter and inorganic species on a non-carbon base sorbent, wherein inorganic species include sodium (Na), calcium (Ca), magnesium (Mg), aluminum (Al), iron (Fe) compounds, and combinations thereof. In some embodiments, the metastable complexes comprise a dihalogen group, such as Br-Cl, Br-Br, complexed with metal-oxygen-metal structures of the base sorbent. In some embodiments, the metastable complexes comprise a halogen atom, complexed with metal-oxygen-metal structures of the base sorbent. In some embodiments, the metastable complexes comprise a hydrohalogen group, complexed with metal-oxygen-metal structures of the base sorbent. In some embodiments, the metastable complexes comprise a Group V or Group VI halide, complexed with metal-oxygen-metal structures of the base sorbent. In some embodiments, the metal-oxygen-metal structures of the base sorbent are complexed with combinations of the functional groups disclosed herein. Without wishing to be limited by a theory, it is believed that mercury capture via chemisorption takes place through the action of mercury oxidation provided by these metastable complexes.

[0066] In embodiments, a carbon base sorbent with Lewis acid sites/groups comprising graphene sheets is activated by a promoter of this disclosure, forming a promoted sorbent. The promoter and

the grapheme sheets of the carbon base sorbent form stable compounds, which are responsible for mercury capture via chemisorption. Without being limited by a theory, it is believed that mercury capture via chemisorption takes place through the action of mercury oxidation provided by these stable compounds. As one skilled in the art would appreciate, the versatility of chemistry associated with the base sorbent (carbon, non-carbon, or combination thereof) and the promoter of this disclosure enables versatile applications of the promoted sorbent system for mercury capture. This is especially advantageous because mercury content in flue gases varies from facility to facility, from operation to operation, and from day to day.

[0067] Examples of non-carbon base sorbents are amorphous forms of tectosilicates that comprise nanoscale cavities lined with Lewis basic oxygen associated with Group I alkali metals and Group II alkaline-earth metals. Such tectosilicates can be found in naturally occurring minerals, including, but not limited to, perlite and pumacite. Examples of non-carbon base sorbents also include amorphous forms of phyllosilicates. It is appreciated that other minerals may be used and also treated chemically and thermally to increase the activity of the base sorbent materials, such as phyllosilicates in the amorphous forms.

[0068] In some embodiments, bentonites are used as non-carbon base sorbents, including sodium bentonite and calcium bentonite. The use of other types of bentonites is contemplated as is known to one skilled in the art. The application of bentonite base sorbents is by introducing them into the flue gas at a location of the mercury capture system wherein the temperature of that location is below 800° C.

[0069] In some embodiments, the base sorbents are treated chemically and/or thermally to increase their activity. For example, perlite as a base sorbent may go through vacuum treatment and then thermal treatment so as to reduce the moisture contained therein, increase its activity, and potentially alter its morphology. Other treatment processes include chemical treatment, such acid treatment and alkaline treatment. These treatment methods may be combined to achieve desired effects as known to one skilled in the art. One of the desired effects is to increase the number of available Lewis acid sites/groups in the carbon base sorbent and/or the number of available Lewis basic sites/groups in the non-carbon base sorbent for subsequent activation via reaction with a promoter disclosed herein.

[0070] Referring now to FIG. 3, a schematic flow diagram is provided of mercury control system 100 comprising preparation of promoted base sorbents and flue gas mercury reduction in accordance with preferred embodiments of the present invention. In the exemplary embodiment shown, there is provided a base sorbent reservoir 110, a halogen/halide promoter reservoir 120, a secondary component reservoir 130, and an alkali component reservoir 180, each of which with corresponding

flow control device(s) 201, 202, 203, and 208/209, respectively. In conjunction with the alkali component reservoir 180, flow control devices 208 and 209 can be used independently, together, or not at all. Further, reservoirs 110, 120, 130 and 180 are optional and can be used in any combination, or not at all, whereby the otherwise stored components can be introduced into the system by other means either together or independently. Further, the alkali and secondary components may not be used at all within the system, if so desired.

[0071] As shown, reservoirs 110, 120, 130, and 180 connect through their respective flow control devices and via associated piping, to transport line 115. Alkali component reservoir 180 may also connect, through respective flow control devices and via associated piping, to transport line 118. A source of air, nitrogen, or other transport gas(es) is provided by gas source 170 to transport line 115 for the purpose of entraining materials discharged from reservoirs 110, 120, 130, and 180 and injecting such materials, via injection point 116, into contaminated flue gas stream 15. A source of air, nitrogen, or other transport gas(es) may be provided by gas source 171 to transport line 118 for the purpose of entraining materials discharged from reservoirs 180 and injecting such materials, via injection point 119, into flue gas stream 15. Gas sources 170 and 171 may be the same or different, as desired. Alternatively, transport gas(es) may be provided to both transport lines 115 and 118 by gas source 170 (connection from source 170 to line 118 not shown). Although gas sources 170 and 171 are shown in FIG. 3 as compressors or blowers, any source of transport energy known in the art may be acceptable, as will be appreciated by those of skill in the art.

[0072] For clarity, single injection points 116 or 119 are shown in FIG. 3, although one skilled in the art will understand that multiple injection points and/or locations are within the scope of the present invention. In the embodiment shown, transport line 15 comprises multiple lines allowing for multiple injections and separate and/or combined injections of base sorbent 110 and promoter 120 and/or 130. One mode of operation, by example, comprises providing base sorbent 110 in a common line which is promoted inline "in-flight" using promoter 120 and/or 130 and injected at point 116. Another mode of operation, by example, comprises transport and injection of a base sorbent 110 in a separate line to a point downstream of the injection of promoter 120 and/or 130 in a line at point 116 which is upstream of injection of base sorbent 110, resulting in in-flight preparation at a promoted sorbent within stream 15.

[0073] In the exemplary embodiment shown, an optional optical density measuring device(s) 204 is connected to transport line 115 and/or 118 to provide signals representative of the optical density inside transport line 115 and/or 118 as a function of time.

[0074] Downstream from injection point 116 and 119 is provided particulate separator 140. By way of illustration and not limitation, particulate separator 140 may comprise one or more fabric filters, one or more ESPs, or other particulate removal devices as are known in the art. It should be further noted that more than one particulate separator 140 may exist, sequentially or in parallel, and that injection point 116 and 119 may be at multiple locations upstream and/or downstream of 140 when parallel, sequential, or combinations thereof exist. Particulate separator 140 produces at least a predominantly gaseous ("clean") stream 142 and a stream 141 comprising separated solid materials. A sorbent/ash separator 150 separates stream 141 into a largely ash stream 152 and a largely sorbent stream 151. Stream 151 may then preferably be passed to an optional sorbent regenerator 160, which yields a regenerated sorbent stream 161 and a waste stream 162.

[0075] An optional continuous emission monitor (hereinafter "CEM") 205 for mercury is provided in exhaust gas stream 35 to provide electrical signals representative of the mercury concentration in exhaust stream 35 as a function of time. The optional mercury CEM 205 and flow controllers 201, 202, 203, 208, and 209 are electrically connected via optional lines 207 (or wirelessly) to an optional digital computer (or controller) 206, which receives and processes signals and preferably controls the preparation and injection of promoted carbon sorbent into contaminated flue gas stream 15.

[0076] In operation, as example, promoted sorbent and/or an optional alkali component is injected into contaminated flue gas stream 15. After contacting the injected material with the contaminated flue gas stream 15, the injected material reduces the mercury concentration, transforming contaminated flue gas into reduced mercury flue gas, 25. The injected material is removed from the flue gas 25 by separator 140, disposed of or further separated by optional separator 150, and disposed of or regenerated by an optional regenerator 160, respectively. The reduced mercury clean flue gas stream 142 is then monitored for mercury content by an optional CEM 205, which provides corresponding signals to an optional computer/controller 206. Logic and optimization signals from 206 then adjust flow controllers 201, 202, 203, 208, and 209 to maintain the mercury concentration in exhaust stream 35 within desired limits, according to control algorithms well known in the art. Flow controllers 201, 202, 203, 208, and 209 can also be adjusted manually or by some other automated means to maintain the mercury concentration in exhaust stream 35 within desired limits, according to control algorithms well known in the art.

[0077] Referring still to FIG. 3, several embodiments are illustrated for preparation and injection of promoted sorbents and/or alkali components in accordance with the present invention. Stream 111 provides for introduction of base sorbent from reservoir 110, as metered by flow controller 201 manually or under the direction of computer 206. The halogen/halide may be combined and react

with the base sorbent according to any of several provided methods. The halogen/halide may preferably be combined via line 121 directly into transport line 115, within which it contacts and reacts with the base sorbent prior to injection point 116 or downstream at point 116. This results in in-flight preparation of a promoted sorbent in accordance with the invention. Further, the halogen/halide may be combined via line *121b* with the base sorbent prior to entering transport line 115. Still further, the halogen/halide may be contacted and react with the base sorbent by introduction via line *121c* into reservoir 110. This option is preferably employed when, for example, reservoir 110 comprises an ebulliated or flueidized bed of base sorbent, through which halogen/halide flows in gaseous form or as a vapor. Of course, the halogen/halide may also preferably be contacted with the base sorbent in liquid form or in a solvent, as discussed previously, and solvent removal (not shown in FIG. 3) may then be provided if necessary as mentioned with respect to embodiments discussed with reference to FIG. 1.

[0078] Similarly, the optional secondary component may be contacted and react directly in transport line 115 via line 131, or optionally as described above with respect to the halogen/halide, via lines *131b* and *131c*.

[0079] Similarly, the optional alkali component from 180 may either be added in transport line 115 directly, or may be injected separately by transport line 118, combining downstream in flue gas 15 for synergistic effects with the base sorbent, promoted sorbent, or optional secondary components. Being able to vary on-site the amount of the optional alkali component relative to base sorbent, promoted sorbent, or optional secondary components is a key feature to overcome and optimize for site-specific operating and flue gas conditions.

[0080] In some preferred embodiments wherein contacting between components and reaction is performed in a liquid or solvent phase, stirring of such liquid and/or slurry mixtures may be provided. In other embodiments, the halogen/halide promoter and optional secondary component(s) may preferably be sprayed in solution form into or on the base sorbent. In some such embodiments, drying, filtering, centrifugation, settling, decantation, or other solvent removal methods as are known in the art may then be provided.

[0081] In embodiments wherein the halogen/halide promoter is in gaseous or vapor form, it may be diluted in air, nitrogen, or other gas as appropriate. The halide/halogen gas, for example, gaseous HBr or Br_2, may be passed through an ebulliated or flueidized bed of granular or fibrous base sorbent, with the promoted sorbent so produced removed from the top of the bed via gas entrainment for injection.

[0082] In some embodiments, the secondary component(s) may preferably comprise iodine or other halogens, hydrohalides, including without limitation HI, HBr, HCl, a Group V or Group VI element with a molecular halogen, such as SCl_2 and others. In some preferred embodiments, the promoted sorbent may comprise from about 1 to about 30 g of halogen/halide per 100 g of base sorbent. In some preferred embodiments, the promoted sorbent may comprise a secondary component in concentration of from about 1 to about 15 wt% of the concentration of the halogen/halide component.

[0083] In still other embodiments, the product-promoted sorbent may be applied to a substrate. In other embodiments, such prepared substrate(s) may be caused to contact a contaminated flue gas or gasification system product gas stream for mercury reduction purposes. Such substrates may be monolithic, rotating, or exposed to the gas stream in any number of ways known to those skilled in the art.

[0084] In some embodiments, a method is provided whereby a mercury stabilizing reagent is added to a promoted sorbent to produce a bifunctional sorbent. Such stabilizing reagent(s) may be sequentially added, either before or after the addition and reaction of the halogen/halide. In some preferred embodiments, the halogen/halide preferably comprises Br or HBr, and the mercury-stabilizing reagent may comprise S, Se, H_2S, SO_2, H_2Se, SeO_2, CS_2, P_2S_5, and combinations thereof.

Halogens in Mercury Capture

[0085] Methodologies for using halogens for the treatment of flue gas have been problematic, owing to their reactivity with other gases and metals, resulting in corrosion and health issues. A "halogen" is defined as a member of the very active elements comprising Group VIIA (CAS nomenclature is used throughout; Group VIIA (CAS) corresponds to Group VIIB (IUPAC)) of the periodic table. In the molecular elemental form of the halogens, including F_2, Cl_2, Br_2, and I_2, the reaction with hot flue gas components leaves little to react with elemental mercury. The atomic elemental halogen form, which includes the flueorine, chlorine, bromine, and iodine atoms, is about a million times more reactive to mercury, but the concentration of the atomic forms is typically extremely low. In a large portion of electric utility coal combustion facilities, the concentrations are generally not sufficient to oxidize a significant amount of mercury.

[0086] The term "halide" as used herein is defined as a compound formed from the reaction of a halogen with another element or radical. In general, halide compounds are much less reactive than the molecular halogens, having a low chemical potential. Halides are considered reduced forms that do not, alone, oxidize other compounds. In the conventional view, therefore, a halide salt-treated sorbent will not effectively oxidize elemental mercury and capture elemental mercury.

Halogen-Promoted Sorbent Characteristics

[0087] The promoted sorbent described here has a very high initial reactivity for oxidizing mercury and therefore, can be used in very small amounts to achieve very high capture efficiencies, thus lowering operation costs and lessening waste disposal problems. In addition, further disposal reductions are obtainable by regenerating and reusing the promoted sorbents produced using the inventive technology. The time interval required for the mercury and the promoted sorbents of the present invention to successfully interact in a flue gas duct, with subsequent collection of the mercury on the promoted sorbent and ash, is very short – less than seconds. Clearly, such collection times require the promoted sorbent to have both high capacity and high reactivity toward mercury. The promoted sorbent can be utilized in a very finely powdered form to minimize mass-transfer limitations. However, again, the reactivity should be very high to capture all of the mercury encountered by the fine particles. Additionally, use of these enhancement technologies allows capture to be effective for larger sorbent particles which also allows separation of the promoted sorbent from the ash to enable subsequent regeneration as well as ash utilization. One feature of this invention is the process to prepare a promoted sorbent containing a halide component formed on and/or within the base sorbent structure that provides a sorbent that is highly active on initial contact with the mercury-contaminated gas stream, which allows for very effective capture of the mercury.

[0088] The inventive sorbents chemically combine bromine species with Lewis acid/basic sites on the base sorbent. For example, x-ray photoelectron spectroscopy has established that the addition of bromine, chlorine, HBr, or HCl formed a chemical compound in the carbon structure. Thus the promoted sorbent produced from halogen and base sorbent does not represent a molecular halogen form, but rather a new chemically modified structure. This phenomenon may not occur with the less reactive iodine, where an I_2 molecular complex can exist on the carbon basal plane. In the case of bromine, modified cationic carbon has a high chemical potential for oxidation of mercury. Thus an entirely new model is presented for the reactivity of the bromine-treated carbon with mercury shown in FIG. 2. The reactive carbon form can preferably be generated by the addition of bromine, hydrogen bromide, or combinations of bromine and other elements, as described herein. Halogen treatment resulted in higher-activity carbons because the halide anions (especially bromide and iodide) were effective in promoting oxidation by stabilizing the developing positive charge on the mercury in the transition state for oxidation. Based on this model, several innovative, inexpensive, activity-enhancing features have been developed.

Optional Second Component

[0089] It has been demonstrated that addition of an optional second component, in addition to the bromine, results in improved reactivity and capacity for the promoted sorbent, typically exceeding that of both the untreated base sorbent and the brominated carbon. The second compound comprises either a second halogen or a compound derived from a second halogen, such as HI. Thus in addition to having a reactive carbon form present, the second component generates a Lewis base with greater ability to stabilize the developing positive charge on the mercury. Thus the second component is an element with more polarized electrons (4p and 5p).

Optional Alkali Component

[0090] It has been demonstrated that addition of an optional alkali component with a base or promoted activated carbon results in improved mercury capture, typically exceeding that of both the untreated carbon and the promoted carbon. Test data indicate that flue gas contaminants, flue gas constituents (SO_2, NO_x, HCl, etc), operating temperature, mercury form, and mercury concentration may impact the effectiveness of the alkali addition. This suggests the need to be able to adjust and tailor the alkali-to-activated-carbon ratio on-site in order to overcome and optimize for a given set of site conditions.

[0091] The synergy that can be gained when coinjecting the two materials can be explained as follows. First, testing shows that binding sites on activated carbon (hereinafter "AC") can be consumed by chlorine species, sulfur species (i.e., sulfates), and other flue gas contaminants (arsenates, selenates, etc). The addition of optional alkali material will interact and react with these species/contaminants, thus minimizing their consumption of AC mercury binding sites. Second, testing also shows that standard AC will continue to oxidize mercury, even though the binding sites are fully consumed. This oxidized mercury can then react with alkali material and subsequently be captured by particulate control devices. Consequently, the addition of the optional alkali component acts to protect mercury-binding sites and capture oxidized mercury, thereby resulting in improved mercury reduction at lower cost. Alkali is generally much lower in cost (an order of magnitude less) than AC; thus more of it can be used, still resulting in overall lower costs.

In-Flight Sorbent Preparation

[0092] As stated previously, the halogen promoted sorbent can be readily produced in-flight. This is accomplished by, for example, contacting the vapors of any combination of halogens and, optionally, a second component, in-flight, with base sorbent particles. The particles may be dispersed in a

stream of transport air (or other gas, such as the flue gas itself), which also conveys the halogen/halide-promoted sorbent particles to the flue gas duct, or other contaminated gas stream, from which mercury is to then be removed. There is no particular temperature requirement for this contact. This technology is obviously very simple to implement, and results in a great cost savings to facilities using this technology for mercury capture.

[0093] Referring to FIGs. 5A and 5B, process flow diagrams are shown as examples of the process for mercury removal from a mercury containing gas, such as a flue gas. In an embodiment shown at FIG. 5A, gas inlet stream 501 passes through chamber 301 and enters air heater 302 as stream 502; then it exits air heater 302 as stream 503 and passes through particulate control device 303 and enters scrubber 304 as stream 504; finally it exits scrubber 304 as stream 505. As shown, chamber 301 is a boiler, however, one skilled in the art will appreciate that chamber 301 can also be the combustion chamber of a coal fired boiler, a stand alone combustion chamber or any other chamber in which mercury containing gas is either generated or passed through. Injection streams 401, 402, 403 and 404, in addition to stream 501, are multiple locations wherein promoter, base sorbent, or a combination of promoter and base sorbent may be introduced.

[0094] FIG. 5B shows an embodiment similar to that of FIG. A, but with the position of the scrubber and particulate control device switched. Specifically, gas inlet stream 501' passes through chamber 301' and enters air heater 302' as stream 502'; then it exits air heater 302' as stream 503' and passes through scrubber 304' and enters particulate control device 303' as stream 504'; finally it exits particulate control device 303' as stream 505'. As shown, chamber 301 is a boiler, however, one skilled in the art will appreciate that chamber 301 can also be the combustion chamber of a coal fired boiler, a stand alone combustion chamber or any other chamber in which mercury containing gas is either generated or passed through. Injection stream locations 401', 402', 403' and 404', in addition to stream 501', represent multiple locations wherein promoter, base sorbent, or a combination of promoter and base sorbent may be introduced.

[0095] At each of the aforementioned injection stream locations 401, 401', 402, 402', 403, 403', 404 and 404', 501, 501' multiple injection points are contemplated so that promoter and base sorbent may be injected as a single injection stream or as separate injection streams, as further illustrated in the following exemplary embodiments.

[0096] In an embodiment, a promoter is introduced to chamber 301 at location 401. A base sorbent (carbon, non-carbon, or their combination) is introduced at location 402 upstream of air heater 302. In a further embodiment, a promoter is introduced to at location 402 upstream of air heater 302. A base sorbent (carbon, non-carbon, or their combination) is also introduced at location 402 either as a

separate stream or as a mixed single stream with the promoter. In another embodiment, a promoter is introduced at locations 401 and 402. A base sorbent (carbon, non-carbon, or their combination) is introduced at location 402 either as a separate stream or as a mixed single stream with the promoter.

[0097] With the aid of this disclosure, one of ordinary skill in the art will be able to configure the process in many different fashions for mercury removal using the promoted sorbent. All these configurations are considered equivalents of the disclosed process and therefore are within the scope of the claimed invention.

Advantages of On-Site Preparation

[0098] In-flight preparation of the halogen/halide-promoted sorbent on location produces certain advantages. For example, the treatment system can be combined with the base sorbent injection system at the end-use site. With this technique, the halogen/halide is introduced to the base sorbent air (or other gas, including to the flue gas or other mercury containing gas) mixture in a transport line (or flue gas duct part of the base sorbent storage and injection system). This provides the following benefits over current conventional concepts for treating sorbents off-site:

[0099] Capital equipment costs at a treatment facility are eliminated.

[00100] Costs to operate the treatment facility are eliminated.

[00101] There are no costs for transporting carbon and additive to a treatment facility.

[00102] The inventive process uses existing hardware and operation procedures.

[00103] The inventive technology ensures that the sorbent is always fresh and, thus, more reactive.

[00104] No new handling concerns are introduced.

[00105] There are no costs for removing carbon from treatment system.

[00106] The inventive process allows rapid on-site tailoring of additive–sorbent ratios in order to match the requirements of flue gas changes, such as may be needed when fuels are changed or loads are reduced, thus further optimizing the economics.

[00107] The inventive technology reduces the amount of spent sorbents that are disposed.

[00108] With the foregoing and other features in view, there is provided, in accordance with the present invention, embodiments including a process for preparing and regenerating halogen/halide-promoted sorbents, whose activity for mercury capture is enhanced by the addition of halogen (e.g., bromine) to the base sorbent structure.

Sorbent Injection Location

[00109] Some of the preferred embodiments contemplate the use of a halogen-promoted sorbent in a powdered form that has been injected into a flue gas stream before or after ash particulates have been removed. Other embodiments of the inventive composition of the halogen-promoted sorbent comprise a powdered modified AC prepared by adding Br_2 or HBr plus a second optional component. Other embodiments allow the addition of the optional alkali component in conjunction with a base AC and/or with the use of a halogen-based sorbent and any other combinations of the sorbent technologies provided in this patent. Other embodiments allow for in-flight preparation of promoted sorbents by using and combining the promoters and base sorbents. Alternatively, embodiments include methods wherein the base sorbent is on a moving contactor consisting of particles or fibers containing one or more of the compositions listed above.

Sorbent Regeneration

[00110] Any of the above embodiments of the halogen/halide-promoted carbon and/or non-carbon sorbent can be easily regenerated; the poisoning contaminants from the flue gas are preferably removed, and an inexpensive promoting agent added, to restore mercury sorption activity. This process of promoting the activity of the carbon and/or non-carbon itself contrasts with the earlier, more expensive, conventional methods of adding a reagent (such as peroxide, gold, triiodide, etc.) to a base sorbent. The halogen/halide-promoted carbon sorbent of the present invention, treated with bromine and/or optional components, is noncorrosive. Detailed examples of sorbent regeneration techniques are described in copending, commonly owned PCT Patent Application No. PCT/US04/12828, titled "PROCESS FOR REGENERATING A SPENT SORBENT," which is hereby incorporated by reference in its entirety.

Sorbent Injection Control Schemes

[00111] Another advantage of the present invention relates to the use of a feedback system to more efficiently utilize certain aspects of the invention. Where possible and desirable, the mercury control technology of the present invention may preferably utilize continuous measurement of mercury emissions as feedback to assist in control of the sorbent injection rate. Tighter control on the sorbent and optional component(s) levels can be achieved in this way, which will ensure mercury removal requirements are met with minimal material requirements, thus minimizing the associated costs. In

an embodiment, the mercury emissions are continuously measured downstream of the injection location, preferably in the exhaust gas at the stack.

EXAMPLES

[00112] To more clearly illustrate the present invention, an example is presented below. This example is intended to be illustrative, and no limitations to the present invention should be drawn or inferred from the example presented herein.

Example 1 – Non-carbon-Promoted Sorbent Tests at Full-Scale Plants

[00113] Full-scale commercial tests were conducted at several coal-burning facilities equipped with ESPs wherein three types of pre-cursers were injected upstream of an ESP at 325 °F. In all, more than thirty tests were performed with variations in base sorbent material, base sorbent material injection rates and promoter injection rates. Promoters were halogen-based materials. Base sorbents were clay-based materials such as perlite and pumacite, which are vesicular forms of tectosilicates comprising silicates and aluminate tetrahedra with alkali metals in the interstitual spaces. Each base sorbent was injected upstream from the ESP.

[00114] The flue gas flow rate for the test was approximately 23 million $dsft^3/hr$ with a corresponding mercury flow rate of 0.0097 lbs Hg/hr. Initial mercury concentration in the flue gas prior to the introduction of the base sorbent or promoted sorbent was approximately 0.000417 lbs Hg/million $dsft^3$.

[00115] As shown in Table 1, each base sorbent was injected at three different test rates: about 100 lb/hr ("Low"), about 150 lb/hr ("Ave.") and about 200 lb/hr ("High"). At each test rate, the mercury removal rate was measured both with and without the use of a promoter to show the relative benefit of introducing the promoter into the flue gas stream. For the tests where promoter was injected into the flue gas stream, promoter was injected at about 20 lb/hr for the "Low" tests, at about 25 lb/hr for the "Ave." tests and from about 30 to about 50 lb/hr for the "High" tests. The percent mercury removal for each test was calculated based on measurements taken from the inlet flue gas and the outlet flue gas. The results as shown in Table 1 clearly show a significant improvement in mercury capture when a promoter and base sorbent are injected, as compared to the injection of a base sorbent alone.

Table 1. Test Data for Non Carbon-Promoted Sorbents

Base Sorbent Material	Base Sorbent Injection Rate (lb/hr)			Promoter Injection Rate (lb/hr)			Percent Removal of Mercury (%)		
	Low	Ave.	High	Low	Ave.	High	Low	Ave.	High
Perlite	100	150	200	0	0	0	37	40	43
	100	150	200	20	25	35	55	72	74
Pumacite	100	150	200	0	0	0	25	25	25
	100	150	200	20	25	50	52	60	65
Clay-Based Mix	100	150	200	0	0	0	50	52	54
of Silica and Alumina	100	150	200	20	25	30	58	65	74

PROVISIONAL APPLICATION

[00116] A reactive sorbent material is described for capture of mercury in a vapor stream. The vapor stream includes flue gas from coal combustion or incineration, synthesis gas from gasification, as well as offgases from mineral processing, metal refining, retorting, cement manufacturing, chloralkali plants, dental facilities, and crematories. The sorbent is especially suited to, but not limited to, use in low-chlorine flue or exhaust gases where the mercury is mainly elemental. The sorbent comprises a bromide-modified carbon form containing a reactive compound produced by the reaction of bromine with the carbon. Other additional promoting substances can be added in smaller amounts to increase the reactivity with and sorption of elemental mercury. This combination results in a carbon bromide structure in the carbon lattice that can oxidize the mercury to a species that is strongly bonded to the carbon structure and, therefore, easily retained on the sorbent at higher temperatures in the presence of flue gas constituents. In some examples, the sorbent consists of a fine or coarse powdered material for injection into the gas stream or a granular or fibrous material for use in a fixed or moving bed. In some examples, the sorbent does not require in situ activation (an induction period) in a flue gas

stream as do conventional activated carbon sorbents. Other additives of base chemistry (Ca, Na, and others) may be added to flue gas as a sorbent mixture, or co-injected to selectively sorb acid gases or other flue gas constituents to keep available reactive sites for mercury oxidation and subsequent capture. The sorbent can be regenerated by washing off contaminating components derived from flue gas that poison the spent sorbent. Novel methods for introduction of the sorbent dispersion into the mercury contaminated gas stream are described.

[00117] Following is an outline of examples of the invention. The invention may also take on various other examples or embodiments, as a person skilled in the art would understand.

[00118] 1. A modified carbon sorbent was prepared by reacting the carbon with molecular bromine by applying a solution of molecular bromine in an organic solvent to the carbon, followed by removal of the modified carbon from the bulk of solvent and further removal of solvent from the pores by drying the carbon in air or nitrogen. The solution may also contain an additional promoting substance in small amounts. In one example, the amount of bromine taken up by the carbon ranges from <1 to about 30g per 100g of activated carbon, depending on the proportions used.

[00119] 1A. (Dependent)

Same as 1, carbon is powdered activated carbon.

Carbon is granular activated carbon.

Carbon is very fine carbon black.

Carbon is very fine carbon fiber.

Carbon is aerogel carbon film.

Carbon is char recovered from pyrolysis process.

Carbon is powdered activated carbon of size distribution larger than fly ash size distribution, so that it can be physically separated from the ash and regenerated for reuse.

Carbon is regenerated from previous usage cycle and recycled.

Other desired types of carbon may also be used.

[00120] 1B. (Dependent)

Same as 1, Solvent is chlorinated hydrocarbon such as dichloromethane.

Same as l, Solvent is hydrocarbon solvent such as petroleum ether or ligroin or pentane or hexane or toluene or benzene.

Same as 1, Solvent is water.

Same as 1, Solvent is carbon disulfide.

Same as 1, Solvent is a waste solvent.

Same as 1, Solvent is an ether.

Same as 1, Solvent is recycled from previous batch.

Same as 1, Solvent is supercritical solvent such as CO_2.

Other desired types of Solvents may also be used.

[00121] 1C. (Dependent)

Same as 1, solution of bromine is applied by stirring the carbon in the bromine solution.

Same as 1, solution of bromine is applied by spraying a solution of molecular bromine in an organic solvent, followed by removal of solvent from the pores by drying the carbon in air or nitrogen.

The bromine may also be applied using other desired techniques.

[00122] 1D. (Dependent)

Same as 1, removal of solvent is by filtration, centrifugation, settling, and decantation and drying in vacuum, air, or other gas.

Same as 1, when sprayed or minimal volume, removal of solvent is by drying in air, vacuum, or other gas.

The solvent may also be removed using other desired techniques.

[00123] 1E. (Dependent)

Same as 1, additional substance is iodine, at 1%-10% of the bromine concentration added.

Same as 1, additional substance is hydrohalide (HI, HBr, HCl), etc:, 1%-10 % of bromine.

Same as 1, additional substance is a compound comprised of a Group V or VI element or combination of Group V or VI with Group VII element, such as SCl_2, 1-10 wt % of bromine.

[00124] 2. A modified carbon sorbent was prepared by reacting the carbon with molecular bromine by contacting the carbon with a gas containing molecular bromine. In one example, the amount of bromine taken up by the carbon ranges from <1 to about 30 g per 100g of activated carbon, depending on the proportions used.

Contacting is by passing the Br_2 gas through a bed of the carbon.

Bed is ebullated or fluidized.

Bed is moving bed of granules or fibers.

Contacting is by admitting Br_2 gas to a duct through which the carbon is transported from a reservoir to the flue gas duct via an air-driven entrainment method, thus promoting the activity of the carbon in-flight.

Same additives as 1E, except these are added in the gas phase, and added in-flight as in 2 above.

[00125] 3. A modified activated carbon sorbent was prepared by reacting the carbon with hydrogen bromide (HBr) by stirring the carbon in a solution of HBr in an organic solvent or in water, followed by removal of the modified carbon from the bulk of solvent and further removal of solvent from the pores by drying the carbon in air or nitrogen. In one example, the amount of bromine taken up by the carbon ranges from <1 to about 30 g per 100g of activated carbon, depending on the proportions used.

Same dependent clauses as in 1A with regard to carbon forms. Same solutions and treatment as 1B,1C, 1D.

Same additives as 1E, added into the solution phase or later in the gas phase, and added in-flight as in 2 above.

[00126] 4. An activated carbon sorbent was prepared by impregnating hydrogen bromide by passing a gas composition containing hydrogen bromide diluted with nitrogen or air through a fluidized bed or ebullated bed of the carbon. In one example, the amount of bromine taken up by the carbon ranges from <1 to about 30 g per 100g of activated carbon, depending on the proportions used.

Same dependent clauses as in 1A with regard to carbon forms.

Contacting options are similar to 2.

[00127] 5. Sequential treatment of activated carbon with bromine or HBr, followed by another mercury stabilizing reagent to generate a highly reactive bifunctional sorbent, the reagent to include sulfur and selenium species, such as H_2S, SO_2, H_2Se, Se, SeO_2, CS_2, P_2S_5.

[00128] 6. Sequential treatment of activated carbon with mercury stabilizing reagent, followed by bromine or HBr to generate a highly reactive bifunctional sorbent, the reagent to include sulfur and selenium species, such as H_2S, SO_2, H_2Se, Se, SeO_2, CS_2, P_2S_5.

[00129] 7. Treatment of a carbon with a Group V or VI element combined with Group VII element, such as PBr_3 or SCl_2. In one example, the amount of Group V or VI halide is 1-30 wt % of the carbon. The compound is added in vapor phase or in solution (solvent is hydrocarbon, chlorinated hydrocarbon, or other solvent as described in 1B, but not water, since the compound is destroyed in water solution).

[00130] 8. The process for preparing the bromine-containing activated carbon sorbent as described in Examples 1-6 and coupled with the injection of the bromine-containing fine-particle sorbent into the contaminated gas stream and subsequent removal of the fine particles of sorbent from the gas stream in a collection device, such as bag filtration of electrostatic precipitator (ESP).

[00131] 9. The process of using additives (1-8) in conjunction with sorbents to capture acid gases and other flue gas constituents that block oxidation reactions or consume sorbent sites that would otherwise capture mercury. The additive is a compound comprised of Group I or II elements, such as Ca, Na, and others. These additives of base chemistry may be added to flue gas as a sorbent mixture or co-injected to selectively sorb acid gases or other gas constituents that compete for mercury reactive/sorption sites, thereby improving the effectiveness of activated carbon to capture mercury. In addition, the base additives can augment the treated activated carbon by helping to capture oxidized mercury forms in the flue gas, such as mercuric chloride, or that are produced on the carbon sorbent, such as mercuric bromide, but are released to the gas phase as the sorbent becomes saturated or capacity limited.

[00132] 10. The process of preparing a larger-than-normal (>40 μm) sorbent particle size, promoting with the halogen treatment as described in 1-8, using the treated sorbent for capture of mercury by injecting in the flue gas, and finally separating and recovering the sorbent from the ash particles. The larger sorbent size thus will allow easy mechanical/physical separation so that sorbent can be regenerated, recycled, and reused, and the ash can be sold as a low-carbon cementatious byproduct for concrete. The separation can be effected by various methods, such as density (gravity), floatation, or sieving methods.

[00133] 11. The process for preparing the bromine-containing activated carbon sorbent as described in Example 1-10, coupled with the direct injection of the slurry of the prepared fine-particle sorbent in the solvent or aqueous phase, so that the aerosol particles of the slurry achieve a high degree of dispersion in the gas stream and evaporation of the solvent in the hot gas occurs

rapidly. The amount of slurry added is flow-controlled, and the concentration of particles in the slurry is monitored by optical density measurements prior to injection. Collection of particles is performed.

[00134] 12. The process for preparing the bromine-containing activated carbon sorbent, as described in Examples 2 and 4, coupled where the fine-particle dispersion of brominated sorbent in the gas stream at the top of the ebullated bed is led to the flue gas or offgas duct where the said dispersion is contacted with mercury-contaminated flue gas or offgas stream. The amount of aerosol dispersion added is controlled by the gas flow to the ebullated bed, and the concentration of particles in the dispersion can be monitored by optical density measurements prior to injection. Collection of particles is performed by the existing particulate-collection equipment.

[00135] 13. The process for preparing the bromine-containing activated carbon sorbent bed, coupled with contacting the bed with the mercury-contaminated flue gas or offgas.

[00136] 14. The process for preparing the bromine-containing activated carbonBsorbent, as described in Examples 2 and 4, or untreated activated carbon, coated on a substrate or as activated carbon material. This material is placed in a moving system that geometrically allows for control of rate of exposure, sorption, and exchange of material in a continuous or semicontinuous manner.

[00137] 15. In the sorbent and mercury removal process outlined in paragraphs above, the bromine reagents promote metal oxidation activity by creating cationic or radical character on the carbon edge structure that attracts mercury atoms and extracts electrons from said mercury atoms, resulting in oxidized mercury, which is more easily captured on a sorbent. A similar mechanism applies to oxidation and capture of reduced arsenic and other pollutant species.

[00138] The invention relates to the process for the removal of mercury and other pollutant species from gas streams generated during the burning of fossil fuels, such as in a coal-fired utility or synthesis gas from gasification facilities. This removal process would utilize a sorbent and/or a combination of additives to remove pollutants from the gas stream, which are at the same time interacting with other gas components that result in poisoning or deactivating the sorbent and reducing its capacity or reaction rates with the targeted pollutant species. The present invention provides a cost-effective way to capture the pollutants by utilizing exceptionally active carbon sorbents and promoting mercury sorbent surface reactions, containing a bromide form of the carbon, that capture mercury with high kinetic chemisorption (oxidation) activity, so that

capture can occur during contact times of seconds or less. The sorbent does not require in situ activation (induction period) in the gas stream to achieve high activity as do conventional activated carbon sorbents. The reactivity of the sorbent toward the pollutants and the sorption capacity can be regenerated, recycled, and reused.

[00139] Burning fossil fuels generates a flue gas that contains mercury (and other trace elements) that was in the coal, plus oxides of sulfur and nitrogen (acid gas emissions) and particulates whose release to the environment must be controlled by use of sorbents, scrubbers, filters, precipitators, and other removal technologies. While control of other elements and/or flue gas pollutants may apply, the discussion provided is focused on mercury. Initially, mercury is released in the elemental form during combustion/gasification, but downstream of the boiler, in the ducts and stack of the combustion system, part of the elemental mercury is oxidized. The amount oxidized depends on the amount of acid gases present in the flue gas and other factors. Amounts of mercury vary with the coal, but a typical concentration of mercury in the stream of combustion gas is about 5 parts per billion (ppb). A pound of mercury or more per day may be emitted in some utilities.

Discussion of Sorbent Technologies

[00140] Several types of mercury control methods for flue gas have been investigated, including injection of fine sorbent particles into a flue gas duct and passing the flue gas through a sorbent bed. Fine-particle injection sorbents include activated carbon, metal oxide sorbent, sodium sulfide particles (for example, see U.S. Patent 6,214,304), and basic silicate or oxide sorbents (for example, see the Ghorishi reference (Ghorishi,B.; Gullet, B.K. Waste Manage Res. 1993, 16, 582). and Lancia references). When particle injection is employed, the mercury chemisorbed to the sorbent particle is removed from the gas stream in a bag house or ESP and collected along with ash particulates (for example, see U.S. Patents 4,889,698, 4,956,162, 5,672,323, 5,827,352, 6,027,551, and 5,505,766). The sulfide and basic silicate and oxide particles are effective only for the oxidized mercury, and the metal oxide sorbents exhibit slower capture kinetics than the carbon particles. Additionally, injection of fine carbon particles into the flue gas stream has been only partially successful in removing mercury, especially elemental mercury, where effective removal of approximately 60% was attained with a baghouse to collect

carbon and ash. Even lower removal rates have been observed when using an ESP to collect the carbon, since the contact time of the carbon with the gas is very short.

[00141] A major problem with existing carbon injection systems is that the sorbent is initially unreactive, and only after exposure to the flue gas for about 20 minutes does the seasoned sorbent become effective and provide capture of 60% of the mercury in the gas. Consequently, these sorbents must be used in large amounts (high sorbent-to-mercury ratios) to effectively capture the mercury. These sorbents can be relatively expensive and cannot be easily separated from the ash, regenerated and reused. The collection of carbon in the ash also creates solid waste disposal problems, and the spent sorbent may contaminate the collected ash for use in various applications.

Use of Halogens in Mercury Capture

[00142] Methodologies for using halogens for the treatment of flue gas have not previously been effective. Halogen is defined as a member of the very active elements comprising Group VII-A of the periodic table. In the molecular elemental halogen form, including F_2, Cl_2, Br_2, and I_2, the reaction with elemental mercury is not fast enough to result in the formation of oxidized mercury in a coal combustion flue gas with conventional ash control technology. The atomic elemental halogen form, which includes F atom, Cl atom, Br atom, and I atom, is about a million times more reactive to mercury, but the concentrations of these forms are extremely low, and also, therefore, cannot result in oxidation of mercury in a utility flue gas.

[00143] A halide is a compound formed from reaction of a halogen with another element or radical. In general, the halide compounds are normally very much less reactive than the molecular halogens, having expended their high chemical potential in forming the low energy halide. The halide is considered a reduced form and cannot therefore oxidize anything by itself. It is for this reason that it is not obvious that a halide-halogen treated activated carbon would be effective at oxidizing elemental mercury and provide effective capture of elemental mercury. In fact, for tests with salts, analytical data show the addition of bromine to an activated carbon or carbon black or soot does form a compound by reacting with the unsaturated groups on the carbon. By applying x-ray photoelectron spectroscopy, it has been determined that bromine or HBr added to carbon black forms chemical compounds within a carbon structure.

[00144] A body of theory has been developed from scientific evidence to explain the nature of the promotion effect of the bromine compounds. This principle is illustrated in FIG. 2, which in step 1 shows the reaction of the hydrogen bromide with the unsaturated structure of the activated carbon. This may be a carbene species on the edge of the graphene sheets structures of the carbon. Molecular bromine or a bromine compound reacts to form a similar structure, with a positive carbon that is active for oxidizing the mercury.

[00145] We now teach that the formation of the new bromide compound with carbon increases the reactivity of the carbon forms toward mercury and other pollutants. The resulting bromide compound is uniquely suited to facilitate oxidation of the mercury. The effectiveness of the oxidation results from the promotion effect of the halide exerted on the developing positive charge on the mercury during the oxidation, known in the chemical art as a specific catalytic effect. Thus, as the mercury electrons are drawn toward the positive carbon, the halide anion electrons are pushing in from the other side, which stabilizes the positive charge developing on the mercury and lowers the energy requirement for the oxidation process. Bromide is especially reactive, owing to the highly polarizable electrons in the outer 4p orbitals of the ion. Thus, adding HBr or Br_2 to the carbon forms a similar carbon bromide, in which the positive carbon oxidizes the mercury with the assistance of the bromide ion.

Prior Art Publications

[00146] The earliest patents that relate to mercury capture on a sorbent are actually not for flue gas mercury control but for capture of mercury from air or other gas mixtures on a carbon or other sorbent. These patents were based on a model that recognized the affinity of halogens for mercury, rather than the formation of a reactive carbon. These patents are discussed below according to the type of halogen used for impregnation.

[00147] One patent that teaches a halogen impregnation (Stock, U.S. Patent 1,984,164, issued in 1934) describes the use of activated carbon or other solid impregnated with a halogen for removing Hg from air. The impregnation method is not specified. This seems to be the most general claim with respect to halogen impregnation. All the statements and claims appear to refer to halogen or iodine, but the patent does not appear to address bromides or other halides or bromide compounds or even specifically iodide or an iodine compound. The only example in the description is iodine impregnation. The patent also is restricted to air systems and did not pertain

to flue gas systems with reactive acid gases. The description did not assume that the iodine formed a reactive carbon species.

[00148] Japanese Patent JP 49-43197 describes the treatment of Hg-contaminated electrolysis cell gas using a metal iodide salt on a support. A similar treatment using a resin impregnated with a metal iodide is described in JP 50-6438. These patents do not appear to represent a carbon bromide compound as specified in this patent application.

[00149] Another early patent (Hilgen, U.S. Patent 3,849,267, issued in 1974) describes a method for Hg removal from a gas which claims mixing molecular chlorine (Cl_2) with the gas to be cleaned and passing it through a nonporous sorbent such as glass wool and NaCl (not carbon). This was evidently not an obvious extension of the Stock patent, since a halogen was introduced as part of the gas phase being cleaned.

[00150] A later patent (deJong, et al., U.S. Patent 4,196,173, issued in 1980) describes a method for Hg removal in air which claims using a bed of activated carbon impregnated with halogen-only Cl_2 is specified in the other claims and examples, and it is prepared by flowing the Cl_2 stream through a carbon bed.

[00151] An improved sorbent for mercury in air was patented by Revoir and Jones (U.S. Patent 3662523, issued in 1972), in which ICl and ICl_3 vapors were impregnated into the activated carbon. No explanation of the increased activity was provided. Since these compounds are interhalogen compounds, the patent did not infringe Stock.

[00152] U.S. Patent 5,891,324 describes an activated carbon containing an acid (HCl, H_2SO_4, or H_3PO_4) for the removal of mercury contained in a liquid phase, such as would occur in a process steam in the oil industry. In this case, the model presented was that mercury is adsorbed from the liquid into the solid carbon phase at relatively low temperatures.

[00153] In U.S. Patent Application 2004/0003716, a method is described for removing mercury from a combustion gas. This method employs an exposure of a finely powdered activated carbon to a molecular bromine gas at an elevated temperature or to HBr to produce a sorbent with good mercury removal ability when injected into the flue gas duct. The model for the efficacy of the Nelson sorbent is not clearly stated, so it can be presumed that the reasoning for using bromine is the simple premise that some bromine form will help capture the mercury, as does iodine and chlorine. The methods for incorporation of the bromine in the Nelson application are not the same as with the present invention, and the Nelson method will not produce the identical carbon

bromide species that are obtained in the art described in this application. The Nelson method lacks many of the features described in this application that impart exceptional activity to the sorbent in a convenient way, for example, the addition of smaller amount of a second more powerful promoting agent, the use of facile solvent systems, including aqueous bromine, and the use of in-flight bromine treatment. Additionally, the patent application does not mention regeneration, recycling, or reuse, or the use of moving contactors or larger particle size to facilitate sorbent-ash separation.

Embodiments of the Invention.

[00154] A sorbent that is initially very reactive in oxidizing mercury can be used in very small amounts to achieve high capture efficiencies, thus lowering operation costs and lessening the disposal problem. In addition, further disposal reduction is made possible by recycling and reusing the sorbent that is produced using this technology. The time interval for the mercury and sorbent to interact in a flue gas duct and the subsequent collection of the mercury on the sorbent and ash may be very short- only seconds. This requires the sorbent to have high capacity and be very reactive toward mercury. A sorbent can be utilized in a very finely powdered form (e.g., 1-10 μm) to minimize mass transfer limitations. But, again, the reactivity should be very high to capture all of the mercury encountered by the fine particles. One feature of this invention is the process to prepare a sorbent containing a bromide compound formed on the carbon structure that provides a sorbent that is highly active on initial contact with the mercury contaminated gas stream, which allows for effective capture of the mercury.

[00155] One possible way to do this is to chemically combine molecular bromine from solution with activated carbon (edge sites). X-ray photoelectron spectroscopy established that the addition of bromine formed a chemical compound in the carbon structure. Thus, the sorbent does not represent a molecular bromine halogen form but a new chemically modified carbon structure. This may not occur with the less reactive iodine, where an I_2- molecular complex can exist on the carbon basal plane. In the bromine case, it is actually the carbon that oxidizes the mercury. Thus, an entirely new model is presented for the reactivity of the bromine-treated carbon with mercury. The reactive carbon form can be generated by the addition of bromine, hydrogen bromide, or combinations of bromine and other elements as described herein. Chlorine treatment resulted in lower-activity carbons because the chloride anion was less effective in promoting the oxidation

by stabilizing the developing positive charge on the mercury in the transition state for oxidation. Based on this model, several innovative, inexpensive, activity-enhancing features have been developed.

[00156] It has been demonstrated that addition of an optional second component, in addition to the bromine, results in improved reactivity and capacity for the sorbent, exceeding that of both the untreated carbon and the brominated carbon. The second compound comprises either a second halogen or a compound from a second halogen, such as HBr. Thus, in addition to having a reactive carbon form present, the second component generates a Lewis base with greater ability to stabilize the developing positive charge on the mercury. Thus the second component is an element with more polarized electrons (4p and 5p).

[00157] Furthermore, we demonstrated that the sorbent can be readily treated with any combination of bromine and the second component in-flight using vapors of these components contacting the very fine carbon particles dispersed in air or other gas stream that conveys the particles to the flue gas duct. There is no particular temperature requirement for this contact. This technology is very simple to implement, so it will result in a great cost savings to the utility using this technology for mercury capture.

[00158] A unique, nonobvious technique for preparation of the treated carbon is through combining the treatment system with the carbon injection system at the end-use site. With this technique, the halogen is introduced to the carbon-air mixture in the transport line (or other part of the sorbent storage and injection system). Benefits over current concepts to treat sorbents off-site include the following:

- Capital equipment costs at a treatment facility are eliminated.
- Costs to operate the treatment facility are eliminated.
- There are no costs for transporting carbon and additive to a treatment facility.
- This process uses existing hardware and operation procedures.
- This technology ensures that the sorbent is always fresh, and thus, more reactive.
- No new handling concerns are introduced.
- There are no costs for removing carbon from treatment system.
- This process allows rapid on-site tailoring of additive-sorbent ratios in order to match the requirements of flue gas changes, such as needed when changing fuels or reducing loads, thus further optimizing the economics.

- This technology reduces the amount of spent sorbents that are disposed.

[00159] With the foregoing and other features in view, there is provided, in accordance with the invention, a process for preparing and regenerating carbon sorbents whose activity for mercury capture is promoted by the addition of bromine to the carbon structure.

[00160] The invention applies to use of a sorbent in a powdered form that has been injected into a flue gas stream before or after ash particulates have been removed. Examples of the composition of the sorbent are a powdered modified activated carbon prepared by adding Br_2 or HBr plus a second optional component. Alternatively, the sorbent is on a moving contactor consisting of particles or fibers containing the compositions listed in the previous sentence. Either type can be regenerated; the poisoning contaminants from the flue gas are removed and an inexpensive promoting agent added to restore mercury sorption activity. This process of promoting the activity of the carbon itself contrasts with the earlier, more expensive art of adding a reagent (such as peroxide, gold, triiodide, etc.) to the sorbent. The activated carbon sorbent treated with bromine and/or the other components is noncorrosive.

[00161] Detailed examples of sorbent regeneration techniques are described in co-pending, commonly-owned PCT patent application No. PCT/US04/12828, titled "PROCESS FOR REGENERATING A SPENT SORBENT", which is incorporated by reference herein.

[00162] Although the invention is described herein as a sorbent material, it is nevertheless not intended to be limited to the details described, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

[00163] The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific exemplary embodiments.

[00164] FIG. 6 is a block diagram illustrating the use of the invention in a coal fueled facility. Of course, the invention can also be used in any other desired type of facility. FIG. 6 shows a boiler for burning pulverized coal. The facility utilizes various devices to clean the exhaust of the boiler. In this example, a baghouse or ESP is used to collect particulates in the exhaust. A scrubber and sorbent bed are also used to remove undesired constituents from the flue gas stream, before being fed to the stack. In the example shown, the sorbent is injected into the flue

gas after the boiler. The additive can be injected where desired (e.g., before, after, or within the boiler).

[00165] Another advantage of the present invention relates to the use of a feedback system to more efficiently utilize the invention. Where possible, the mercury control technology of the present invention will utilize measurement of mercury emissions as feedback to assist in control of the sorbent injection rate. Tighter control on the sorbent levels in this way will ensure mercury removal requirements are met with the minimal sorbent requirements and therefore the associated costs will be minimized. In one example, the emissions are measured at the stack.

Carbon Sorbent

[00166] Reactions of halogens and acidic species with the basic binding sites on the activated carbon sorbent create sites for oxidizing mercury. Other metal ions, such as boron, tin, arsenic, galium, Sb, Pb, Bi, Cd, Ag, Cu, Zn, or other contaminants, will also react with the oxidation sites generated on the carbon.

[00167] According to our model, adding the bromine from the bromine reagent or a proton from a hydrogen halide acid to a basic carbene site on the carbon edge structure forms a carbocation that accept electrons from the neutral mercury atom forming the oxidized mercury species that is bound to the sorbent surface. The reactive site may also generate reactive bromine radicals or carbon radicals at the active sites on the carbon. Thus, the activated carbon serves to stabilize the bromine, yet provides a highly reactive bromine- containing reagent that can oxidize the mercury and promote its capture on the activated carbon. The sorbent that contains bromine is expected to be more reactive than the corresponding sorbent containing chlorine and much less expensive than the sorbent containing iodine.

[00168] A bench-scale procedure based on the above description was used to test the initial activities and capacities of several powdered carbon sorbents, including the bromine-containing activated carbons prepared from a commercially available sorbent and an aerogel carbon film sorbent, as well as the original precursor carbons for comparison. Bromine-treated carbons were prepared by impregnation of the powdered activated carbon precursors in a stirred solution of bromine in carbon tetrachloride or methylene chloride, or alternatively, in an aqueous solution of HBr, followed by drying in air at ambient temperature and drying in an oven at 100°C in air or nitrogen. Bromine-treated carbons were also prepared by impregnating bromine from the gas

phase by passing the gas through a rotating dry bed of the activated carbon precursor. Adding a second component to the solution was demonstrated to improve the capacity of the sorbent.

[00169] The carbons were initially tested in a heated bed, where a synthetic flue gas stream containing elemental mercury (11 $\mu g/m^3$) was passed through the bed. Concentrations of total and elemental Hg in the effluent gas were determined using a Sir Galahad mercury CEM. The powdered sorbent was supported on a quartz filter during the test, and the other sorbents were tested as a triple layer.

[00170] A comparison of the original commercial-grade powdered carbon sorbent with the sorbent after it has been treated with 0.1 N HBr, collecting the powder by centrifugation and drying, revealed that the mercury capture activity is increased from an initial capture efficiency of about 50% of the Hg in the inlet to 100% capture. A comparison of the sorbent after subsequent regeneration with HBr indicates that it not only captures mercury at the same level as before (100% capture) but is enhanced such that its capacity is prolonged by several minutes. Similar results were obtained with the carbon film and carbon fiber sorbents by treatment with molecular bromine in solution or in dry beds as described above.

[00171] An activated carbon sorbent was prepared by treating the carbon by impregnating molecular bromine from a gas composition containing molecular bromine by flowing the gas through a liquid bromine reservoir in series with a fluidized bed of ebullated bed of the carbon. The amount of bromine taken up by the carbon ranges (in one example) from <1 to about 30 g per 100 g of activated carbon, depending on the proportions used.

[00172] In one exemplary test conducted at a facility fired with lignite coal, the flue gas phase mercury (elemental) concentration was between 10 and 11 $\mu g/m^3$. The ash and injected carbons were collected in the baghouse at 350E to 375EF. Injection of commercial-grade activated carbon powder (untreated) at a rate of 1.0 lb/Macf resulted in mercury effluent concentrations of 3.8-4.2 $\mu g/m^3$ (representing 62%-58% removal of the mercury from the gas), and at 2.0 lb/Macf, gave 74%-71% removal. Injection of the bromine-treated carbon at 1.0 lb/Macf resulted in 73%-69% removal and at 2.0 lb/Macf gave 86%-84% removal. Thus, a significant increase in the mercury capture was exhibited during use of the bromine-treated carbon.

Addendum: Other References to Hg Sorption

Sorbent Beds with Particulate Removal

[00173] Carbon beds have also been utilized for mercury capture in flue gas. The German Patent 34 26 059 describes the use of a very thick carbon bed for treatment of flue gases containing polyhalogenated compounds. Although the system employed at Dusseldorf would also have the potential for Hg removal (for example, see the Streng reference), it is not very practical to use such a thick bed. Spent sorbent is burned and not regenerated. The carbons are not pretreated.

[00174] The GE-Mitsui-BF system (Tsuji, K.; Shiraishi, I.; Dague, R.F. Proceedings, Sixth International Symposium, Air & Water Management Assoc., New Orleans, LA, March 10-12, I993) employs a recirculating carbon bed, where mercury is removed along with acid gases (as ammonium salts) and the carbon is regenerated at high temperatures where ammonium sulfate is decomposed to SO_2 and N_2 and mercury is converted to the elemental form, which desorbs from the sorbent. Attrition of the sorbent results in a significant sorbent cost. The carbons are not pretreated.

Sorbent Injection After Particulate Removal

[00175] A process of injecting manganese oxide sorbent particles is described in U.S. Patent Application 2002/0150516. Regeneration is claimed by removal of spent oxide particles from the reaction zone and rinsing with dilute aqueous acid.

Sorbent Beds After Particulate Removal

[00176] Of particular interest in designing a mercury control process is to use the sorbent downstream of a particulate control device so the sorbent is not highly diluted with the ash particles. The sorbent could then be more easily regenerated and recycled. The prior art teaches several examples of this type of configuration and sorbent processing.

[00177] U.S. Patent 5,607,496 teaches the oxidation of mercury on a metal oxide sorbent bed and subsequent absorption to sorbent. The sorbent bed follows the particulate-removal equipment and, thus, the gas still contains the SO_x and NO_x, which react with the metal oxide sorbent to form the metal sulfates, which poison the bed. High temperatures are proposed to regenerate the bed. However, Hg is only partially removed from the sorbent at temperatures up to 500°C. The sorbents do not work effectively after regeneration using this technique; the

problem may be that manganese sulfate formed during the sorption cycle does not completely decompose back to an active manganese oxide form.

[00178] U.S. Patent 6,383,981 describes a fixed MnO_2 or Fe_2O_3 bed for removal of Hg from a hydrocarbon stream. No regeneration method appears to be included.

[00179] A recent U.S. Patent application (2001/0003116) describes the regeneration of a plate or honeycomb material composed of transition metal oxides that was used for sorption of mercury in flue gas. The claimed process involves heating the sorbent in a reducing gas stream to remove poisons, followed by impregnation with a polyfunctional complex-forming reagent containing the catalyst active component to restore mercury capture capacity. The first of these steps can remove the mercury, but it is unclear whether it actually removes the sulfate poison. The second of these steps is rather expensive, because one is actually reconstituting the reagent on the sorbent

[00180] Porous beds containing a mercury oxidizing reagent on a solid support are described in several patents for removal of mercury from gas streams. These include peroxomonosulfate (for example, see U.S. Patent 4,786,483), triiodide or other mixed halogens (for example, see U.S. Patents 3,194,629; 3,662,523), or sulfur (for example, see U.S. Patents 3,194,629, 4,101,631, 4,708,853, 6,258,334). The reagent material is destroyed either by reaction with the flue gas during sorption or by attempts to regenerate the sorbent; there is no way to regenerate these sorbents, except by reimpregnation of the expensive reagent.

[00181] Amalgamating noble metals (gold, silver) on a suitable support can be regenerated by microwave heating (for example, see U.S. Patent 6,136,072), but they are expensive and not especially active for sorption in flue gas.

Hg Sorbents for Air or Natural Gas Treatment

[00182] Melkersson (U.S Patent 3786619) described a Hg sorbent comprising SeO_2 or SeS_2 for air treatment. This method did not appear to employ a carbon support or halide.

[00183] Yan (U.S. Patent 4814152) described a Hg sorbent comprising elemental sulfur and a metal catalyst on a carbon support. This method did not appear to employ a halide.

[00184] Attia (U.S. Patent 65080281) described a sorbent for mercury and a variety of other contaminants comprising an inorganic aerogel composition. This method did not appear to employ a carbon support or halide.

Following is a List of Various Background References:

Lancia, A.; Musmarra, D.; Pepe, F.; Volpicelli, G. *Combust. Sci. & Technol.* **1993,** *93,* 277.

Streng, S.; Kassebohm, B. *Fuel Proc. Technol.* **1994,** *39,431.*

U.S. Patent 6,214,304 Rosenthal

U.S. Patent 4,889,698 Moller

U.S. Patent 4,956,162 Smith

U.S. Patent 5,672,323 Bhat.

U.S. Patent 5,827,352 Altman

U.S. Patent 6,027,551 Hwang

U.S. Patent 5,505,766 Chang

U.S. Patent 5,607,496 Brooks

U.S. Patent 6,383,981 Blankenship

U.S. Patent 4,786,483 Audeh

U.S. Patent 3,194,629 Dreibelbis, et al

U.S. Patent 4,101,631 Ambrsini, et al

U.S. Patent 3,662,523 Revoir

U.S. Patent 4,708,853 Matviya

U.S. Patent 6,258,334 Gadkaree

U.S. Patent 6,136,072 Sjostrom

U.S. Patent Application 2002/0150516

U.S. Patent Application 2001/0003116 Neufert

[00185] While the preferred embodiments of the invention have been shown and described, modifications thereof can be made by one skilled in the art without departing from the spirit and teachings of the invention. The embodiments described herein are exemplary only and are not intended to be limiting. Many variations and modifications of the invention disclosed herein are possible and are within the scope of the invention. Accordingly, the scope of protection is not limited by the description set out above, but is only limited by the claims which follow, that scope including all equivalents of the subject matter of the claims.

[00186] The examples provided in the disclosure are presented for illustration and explanation purposes only and are not intended to limit the claims or embodiment of this invention. While the

preferred embodiments of the invention have been shown and described, modifications thereof can be made by one skilled in the art without departing from the spirit and teachings of the invention. Process criteria, equipment, and the like for any given implementation of the invention will be readily ascertainable to one of skill in the art based upon the disclosure herein. The embodiments described herein are exemplary only and are not intended to be limiting. Many variations and modifications of the invention disclosed herein are possible and are within the scope of the invention. Use of the term "optionally" with respect to any element of the invention is intended to mean that the subject element is required, or alternatively, is not required. Both alternatives are intended to be within the scope of the invention.

[00187] The discussion of a reference in the Background is not an admission that it is prior art to the present invention, especially any reference that may have a publication date after the priority date of this application. The disclosures of all patents, patent applications, and publications cited herein are hereby incorporated herein by reference in their entirety, to the extent that they provide exemplary, procedural, or other details supplementary to those set forth herein.

[00188] Although the invention is described herein as a promoted sorbent material and associated processes for its preparation and use, it is nevertheless not intended to be limited to the details described, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

What is claimed is:

1. A method for separating mercury from a mercury and ash containing gas comprising:

chemically reacting at least a portion of a carbon sorbent material and at least a portion of a non-carbon sorbent material with a halogen or a halide promoter to form a promoted halogenated carbon sorbent and a promoted halogenated non-carbon sorbent;

chemically reacting elemental mercury in the mercury containing gas with the promoted halogenated carbon sorbent and the promoted halogenated non-carbon sorbent to form a mercury/sorbent chemical composition; and

separating particulates from the mercury containing gas to form a cleaned gas, the particulates including ash and the mercury/sorbent chemical composition.

.

ABSTRACT

A promoted carbon and/or non-carbon base sorbent are described that are highly effective for the removal of mercury from flue gas streams. The promoted sorbent comprises a carbon and/or non-carbon base sorbent that has reacted with and contains forms of halogen and halides. Optional components may be added to increase and/or preserve reactivity and mercury capacity. These may be added directly with the base sorbent, or in-flight within a gas stream (air, flue gas, etc.), to enhance base sorbent performance and/or mercury capture. Mercury removal efficiencies obtained exceed conventional methods. The promoted sorbent can be regenerated and reused. Base sorbent treatment and preparation methods are also described. New methods for in-flight preparation, introduction, and control of the active base sorbent into the mercury contaminated gas stream are described.

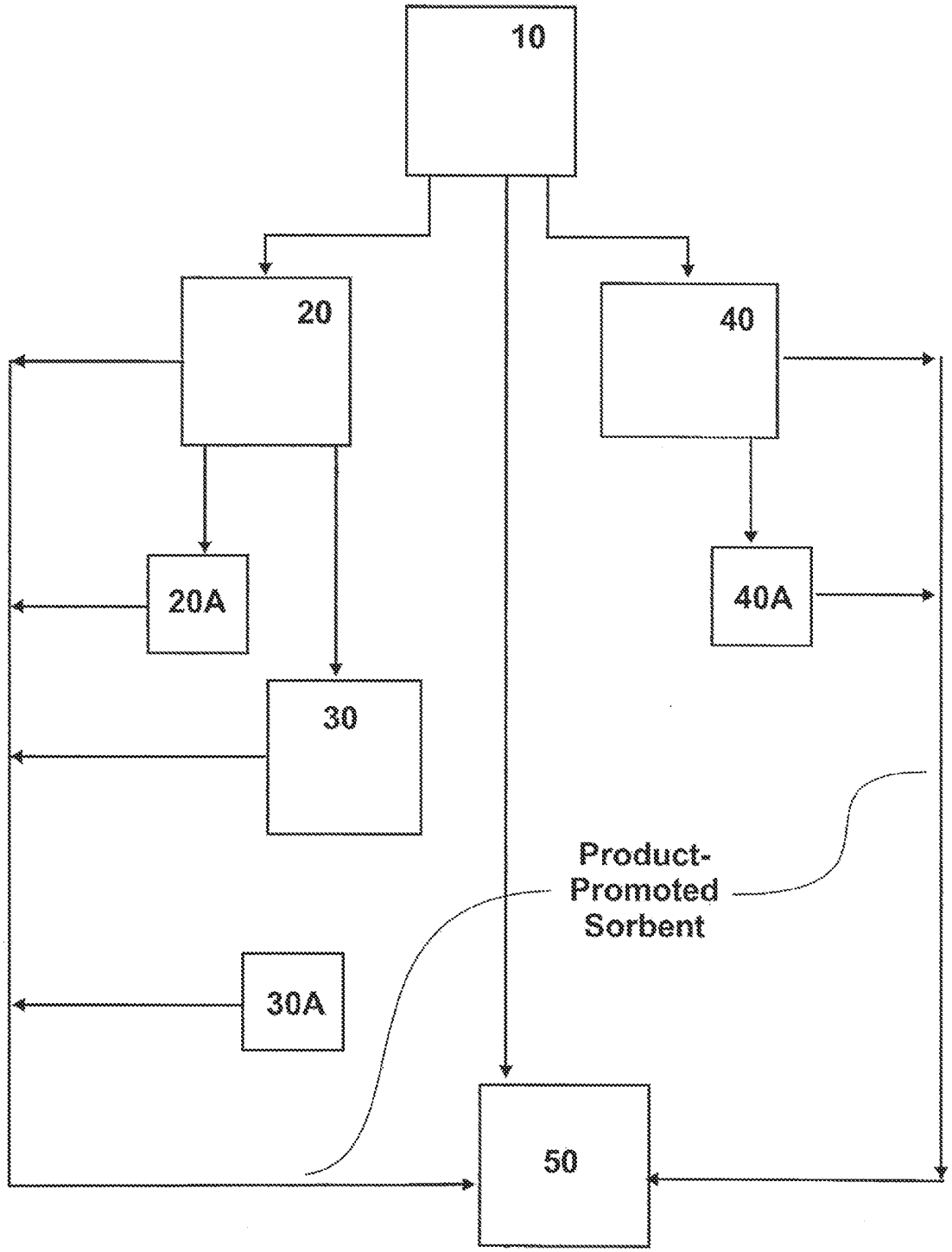


FIG. 1

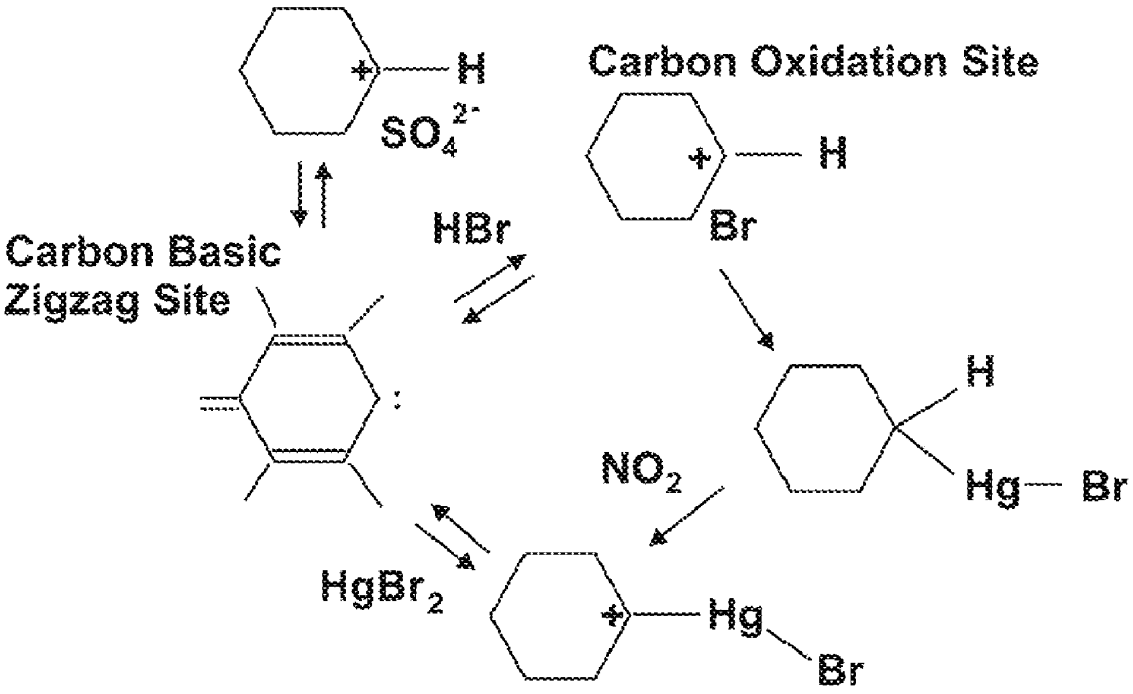

Carbon Oxidation Site
H
SO_4^{2-}
H
Br
HBr
Carbon Basic
Zigzag Site
H
Hg
Br
NO_2
$HgBr_2$
Hg
Br

FIG. 2

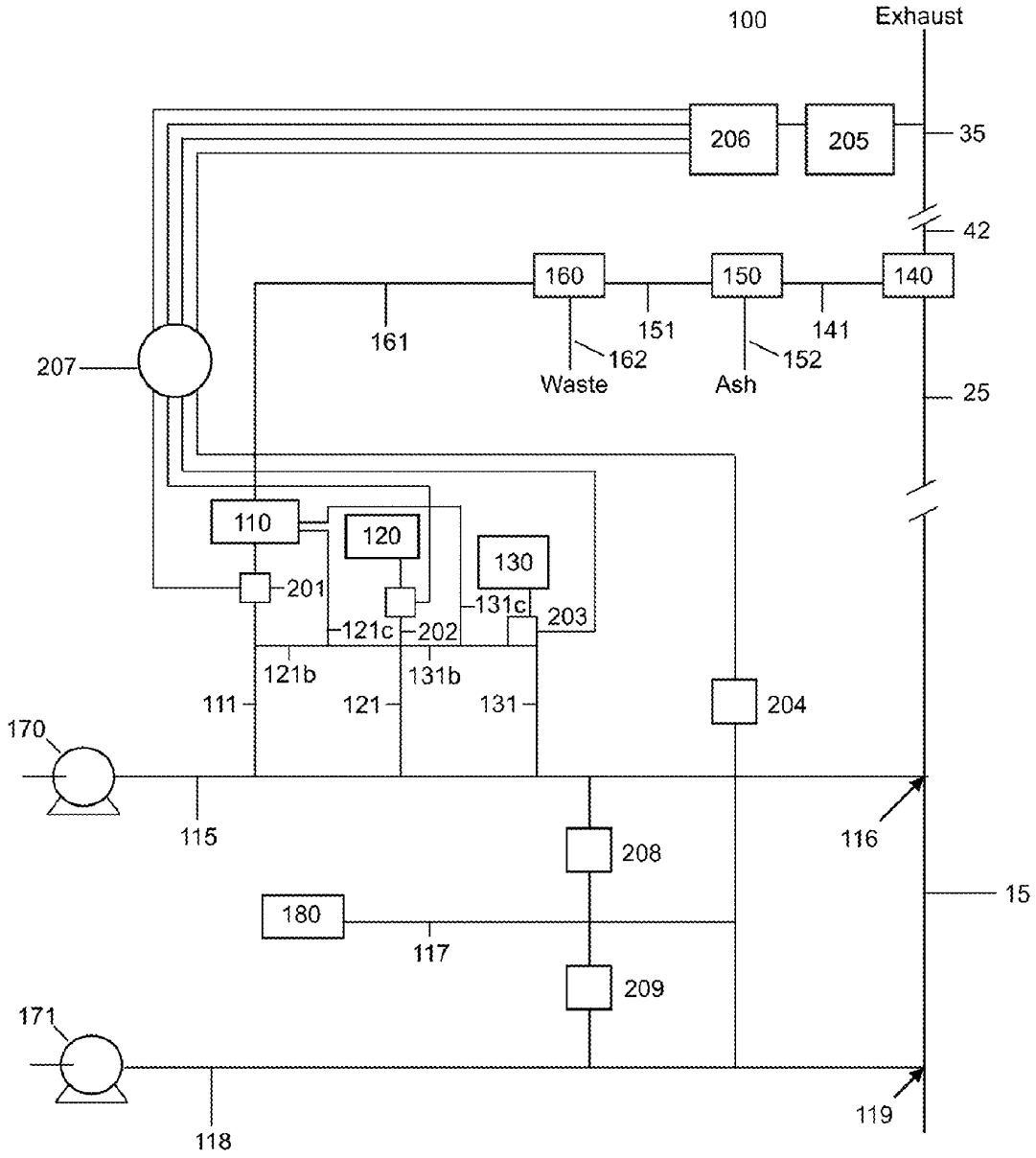

100
Exhaust
206
205
35
42
160
150
140
161
151
141
162
152
Waste
Ash
207
25
110
120
130
201
131c
203
121c
202
121b
131b
111
121
131
204
170
115
116
208
15
180
117
209
171
118
119

FIG. 3

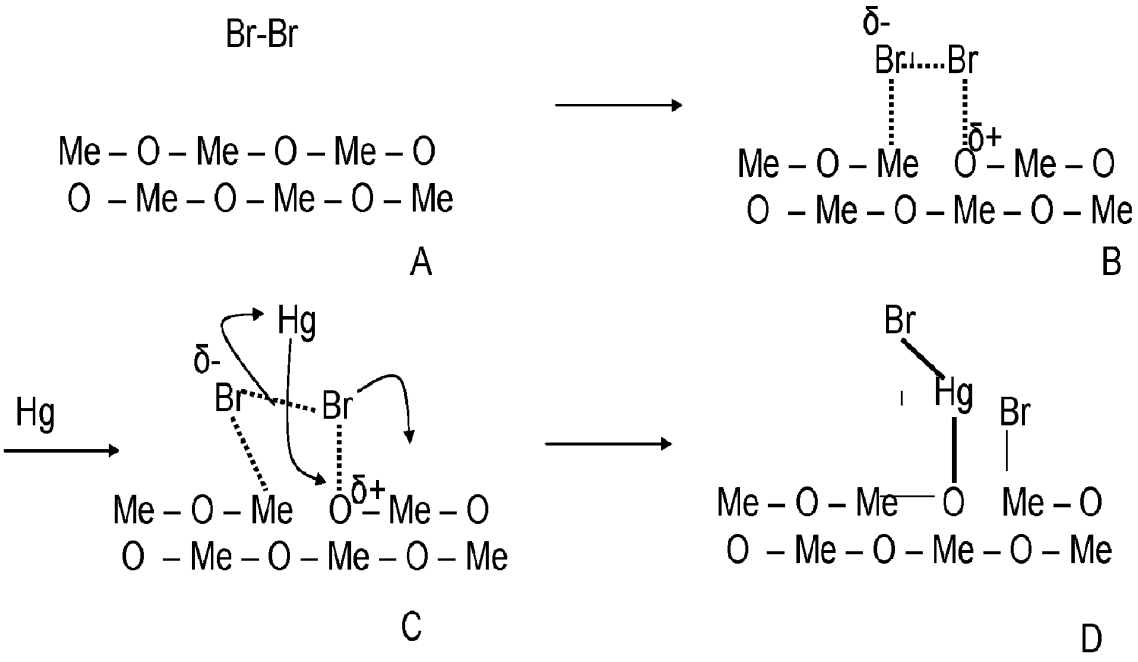

Br-Br
Me – O – Me – O – Me – O
O – Me – O – Me – O – Me
A
δ-
Br
Br
δ+
Me – O – Me O – Me – O
O – Me – O – Me – O – Me
B
Hg
Hg
δ-
Br
Br
δ+
Me – O – Me O – Me – O
O – Me – O – Me – O – Me
C
Br
Hg
Br
Me – O – Me O Me – O
O – Me – O – Me – O – Me
D

FIG. 4

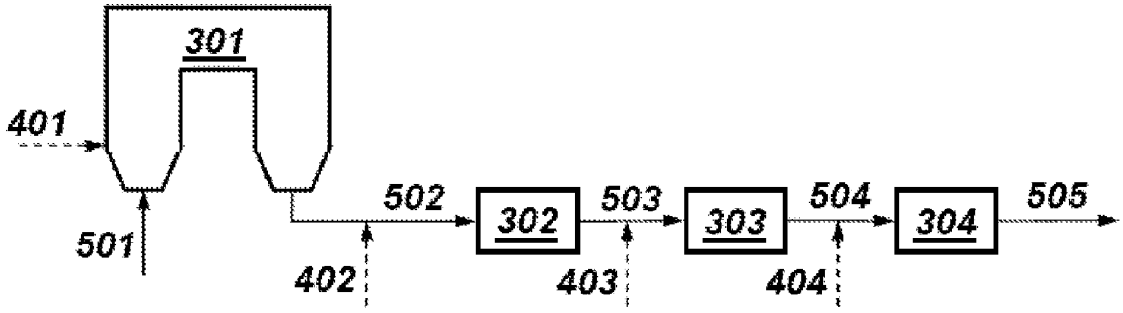

301
401
501
502
302
503
303
504
304
505
402
403
404

FIG. 5A

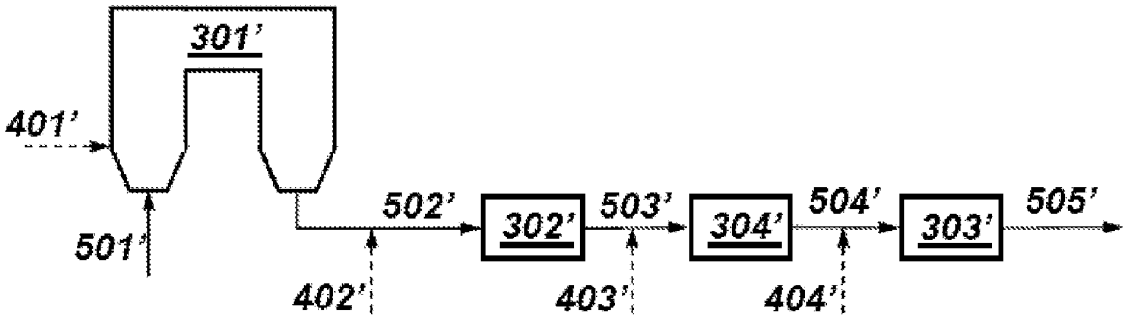

301'
401'
501'
502'
302'
503'
304'
504'
303'
505'
402'
403'
404'

FIG. 5B

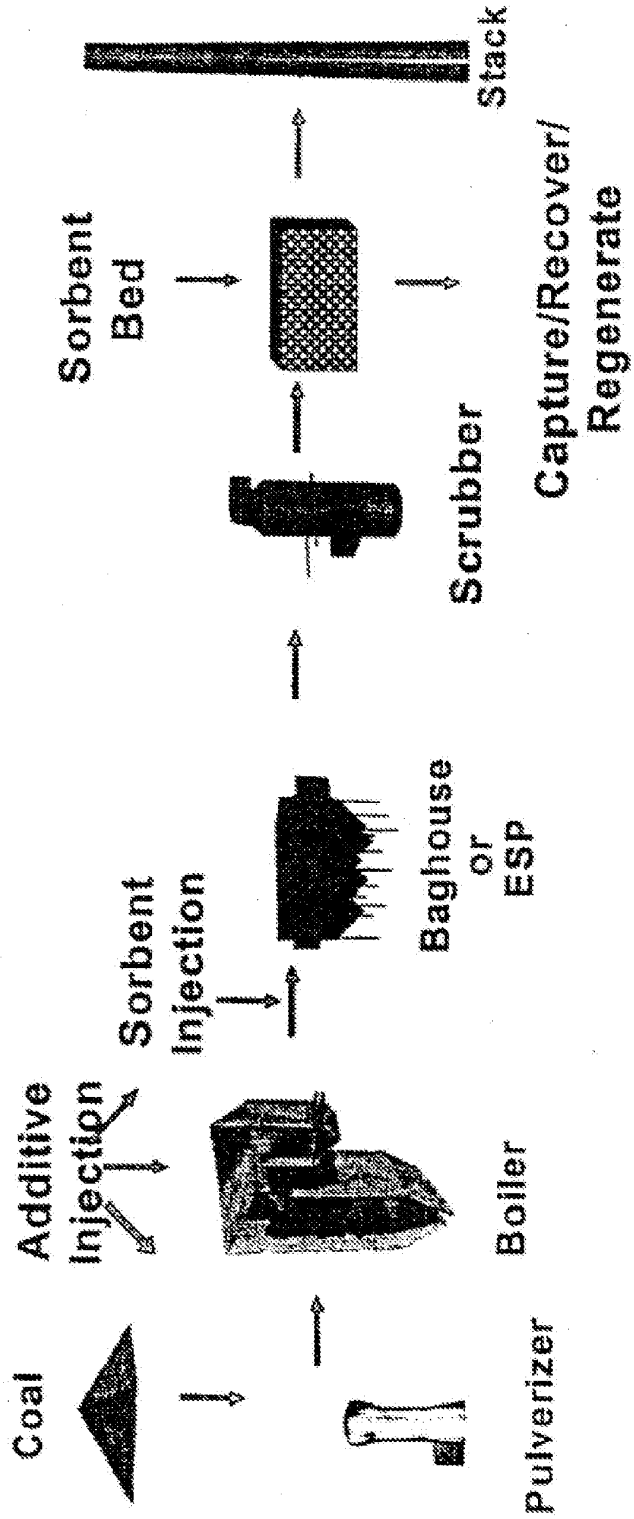

Coal
Pulverizer
Boiler
Additive Injection
Sorbent Injection
Baghouse or ESP
Scrubber
Capture/Recover/ Regenerate
Sorbent Bed
Stack

FIG. 6

PTO/AIA/01 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it 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 14/102,896

filed on December 11, 2013.

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

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

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

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): _____

Signature: _____

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

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.**

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.

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 14/102,896 filed on December 11, 2013.

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

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

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

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: Michael J. Holmes Date (Optional): 12/20/13

Signature: Michael J. Holmes

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

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.

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.

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 14/102,896 filed on December 11, 2013.

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

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

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

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: Edwin S. Olson Date (Optional): _____

Signature: Edwin S. Olson

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

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.

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.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Jose M. Nunez/Megan Reed
Attorney Docket Number:	4820.007US4

Filed as Large Entity

Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
Miscellaneous-Filing:				
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**5860**

Electronic Acknowledgement Receipt

EFS ID:	32616514
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jose M. Nunez/Megan Reed
Filer Authorized By:	Jose M. Nunez
Attorney Docket Number:	4820.007US4
Receipt Date:	14-MAY-2018
Filing Date:	
Time Stamp:	15:46:59
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_007US4_Application2.pdf	1592767 39024b5cccfee753468bf7ddc788357244fab841	yes	68

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal of New Application	1	1
	TrackOne Request	2	2
	Application Data Sheet	3	9
	Specification	10	54
	Claims	55	55
	Abstract	56	56
	Drawings-only black and white line drawings	57	62
	Oath or Declaration filed	63	68

Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38378 10fbba650809a39dea5f43a9c48aca700a46fb06	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1631145		

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.

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 06/06/2018

ASAHLE SALE #00000012 Mailroom Dt: 05/14/2018 190743 15978760

01	FC : 1011	300.00	DA
02	FC : 1111	660.00	DA
03	FC : 1311	760.00	DA
04	FC : 1817	4,000.00	DA
05	FC : 1830	140.00	DA

S/N UNKNOWN **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al. Examiner: UNKNOWN

Serial No.: 15/978,760 Group Art Unit: UNKNOWN

Filed: 5/14/2018 Docket: 4820.007US4

Customer No.: 21186 Confirmation No.: 6432

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

PRELIMINARY AMENDMENT

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

Prior to taking up this application for examination, please enter the following amendments:

IN THE CLAIMS

1. (Canceled)

2. (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 Br_2, HBr, Br^-, or a combination thereof;

injecting a sorbent material 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;

reacting mercury in the mercury-containing gas with the promoted sorbent, to form a mercury/sorbent composition;

separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas;

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 a desired level.

3. (New) The method of claim 2, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas.

4. (New) The method of claim 2, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas on the sorbent.

5. (New) The method of claim 2, wherein the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material.

6. (New) The method of claim 2, wherein the combustion chamber comprises the halogen or halide promoter.

7. (New) The method of claim 2, wherein a promoter precursor is on the coal, wherein the combusting of the coal forms the halogen or halide promoter in the mercury-containing gas.

8. (New) The method of claim 2, wherein the promoter is reacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.

9. (New) The method of claim 2, further comprising injecting a secondary material into the mercury-containing gas downstream of the combustion chamber.

10. (New) The method of claim 9, wherein the secondary material comprises a halogen, a compound derived from a halogen, a hydrohalide, a compound comprising a Group V or Group VI element and a molecular halogen, or a combination thereof.

11. (New) The method of claim 2, wherein the sorbent material injected into the mercury-containing gas further comprises a non-carbon sorbent material.

12. (New) The method of claim 11, wherein the non-carbon sorbent material comprises at least one of a porous felsic material, a vesicular felsic material, a porous basaltic material, a vesicular basaltic material, a clay-based compound, an alkaline compound, a calcium hydroxide compound, a sodium acetate compound, and a bicarbonate compound.

13. (New) The method of claim 2, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.

14. (New) The method of claim 2, wherein the sorbent material injected into the mercury-containing gas is substantially free of halogen and halide promotion.

15. (New) The method of claim 2, wherein the sorbent material is a product-promoted sorbent obtained by reaction of a base sorbent with another halogen or halide promoter.

16. (New) The method of claim 2, wherein the combustion chamber comprises a boiler.

17. (New) The method of claim 2, wherein the mercury-containing gas is a flue gas.

18. (New) The method of claim 2, wherein the injection of the sorbent material into the mercury-containing gas occurs upstream of an air pre-heater.

19. (New) The method of claim 2, wherein the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber.

20. (New) A method for separating mercury from a mercury-containing gas, the method comprising:

reacting mercury in a mercury-containing gas with an injected in-flight promoted activated carbon sorbent to form a mercury/sorbent composition, wherein the promoter comprises Br_2, HBr, Br^-, or a combination thereof;

separating the mercury/sorbent composition from the mercury-containing gas;

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 a desired level, wherein the method removes greater than 70 wt% of the mercury in the mercury-containing gas.

21. (New) The method of claim 20, wherein reacting the mercury in the mercury-containing gas with the promoted halogenated activated carbon sorbent to form the mercury/sorbent composition comprises reacting the mercury in the mercury-containing gas with the promoted halogenated activated carbon sorbent and with a promoted halogenated non-carbon sorbent to form the mercury/sorbent composition.

REMARKS

No claims are amended, claim 1 is canceled, and claims 2-21 are added; as a result, claims 2-21 are now pending in this application.

No new matter is added via the new claims herein.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9580 to facilitate prosecution of this application.

If necessary, 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 May 15, 2018 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

Electronic Acknowledgement Receipt

EFS ID:	32628873
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jose M. Nunez/Megan Reed
Filer Authorized By:	Jose M. Nunez
Attorney Docket Number:	4820.007US4
Receipt Date:	15-MAY-2018
Filing Date:	
Time Stamp:	14:56:01
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		SIGNED_4820_007US4_Prelim Amdmt.pdf	116458 68b3d38cd7d1c45b8c1d3d6ffb3bbbd7a263c1e9	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Preliminary Amendment	2	2
	Claims	3	7
	Applicant Arguments/Remarks Made in an Amendment	8	8
Warnings:			
Information:			
	Total Files Size (in bytes):	116458	

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.:	4820.007US4	Serial No.:	15/978,760
Filed:	May 14, 2018	Due Date:	N/A
Examiner:	Unknown	Group Art Unit:	Unknown
Customer No.:	21186	Confirmation No.:	6432

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 Preliminary Amendment (7 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

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 1 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-1,984,164	12/11/1934	Alfred, Stock
	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.
	US-20020134242A1	9/26/2002	Yang, Ralph T, et al.
	US-20020150516A1	10/17/2002	Pahlman, John, et al.
	US-20030057293A1	3/27/2003	Boecking, Friedrich
	US-20030104937A1	6/5/2003	Sinha, R. K.
	US-20030136509A1	7/24/2003	Virtanen, Jorma
	US-20030206843A1	11/6/2003	Sidney Jr, Nelson G
	US-20030206846A1	11/6/2003	Jangbarwala, Juzer
	US-20040003716A1	1/8/2004	Nelson Jr, Sidney
	US-20040013589A1	1/22/2004	Vosteen, Bernhard, et al.
	US-20040076570A1	4/22/2004	Jia, Charles Q
	US-20040109800	6/10/2004	Pahlman, John E, et al.
	US-20050000197A1	1/6/2005	Krantz, Jeffrey
	US-20050019240A1	1/27/2005	Lu, Xiao-chun, et al.
	US-20050074380A1	4/7/2005	Boren, Richard M, et al.
	US-20050147549A1	7/7/2005	Lissianski, Vitali Victor, et al.
	US-20050227146A1	10/13/2005	Ghantous, Dania, et al.
	US-20060048646A1	3/9/2006	Olson, Edwin S, et al.
	US-20060057044A1	3/16/2006	Chang, Shih-ger, et al.
	US-20060112823A1	6/1/2006	Avina, David Christopher
	US-20060191835A1	8/31/2006	Petrik, Viktor I, et al.
	US-20060204418A1	9/14/2006	Chao, Chien-chung, et al.
	US-20070167309A1	7/19/2007	Olson, Edwin S.
	US-20070168213A1	7/19/2007	Comrie, Douglas C
	US-20070234902A1	10/11/2007	Fair, David L, et al.
	US-20070295347A1	12/27/2007	Paine III, John B, et al.
	US-20080090951A1	4/17/2008	Mao, Dongsheng, et al.
	US-20080107579A1	5/8/2008	Downs, William, et al.
	US-20080134888A1	6/12/2008	Chao, Chien-chung, et al.
	US-20080182747A1	7/31/2008	Sinha, R. K.
	US-20080207443A1	8/28/2008	Gadkaree, Kishor Purushottam, et al.
	US-20080292512A1	11/27/2008	Kang, Shin G.

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 2 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20090031708A1	2/5/2009	Schmidt, Darren D.
	US-20090062119A1	3/5/2009	Olson, Edwin S., et al.
	US-20090081092A1	3/26/2009	Yang, Xiaolin David, et al.
	US-20090136401A1	5/28/2009	Yang, Xiaolin David, et al.
	US-20090235848A1	9/24/2009	Eiteneer, Boris Nikolaevich, et al.
	US-20090320678A1	12/31/2009	Chang, Ramsay, et al.
	US-20100024642A1	2/4/2010	Fukumoto, Kazuhiro, et al.
	US-20100047146A1	2/25/2010	Olson, Edwin S., et al.
	US-20110076210A1	3/31/2011	Pollack, Nicholas R, et al.
	US-20110168018A1	7/14/2011	Mohamadalizadeh, Ali, et al.
	US-20120183458A1	7/19/2012	Olson, Edwin S, et al.
	US-20130280156A1	10/24/2013	Olson, Edwin S, et al.
	US-2014/0224121A1	8/14/2014	Mimna, Richard A., et al.
	US-20140056787A1	2/27/2014	Olson, Edwin S, et al.
	US-20140255279A1	9/11/2014	Olson, Edwin S, et al.
	US-20140308188A1	10/16/2014	Olson, Edwin S, et al.
	US-20150098878A1	4/9/2015	Olson, Edwin S
	US-20150246315A1	9/3/2015	Olson, Edwin S, et al.
	US-20170100692A1	4/13/2017	Olson, Edwin S, et al.
	US-20170128908A1	5/11/2017	Olson, Edwin S., et al.
	US-20170173524A1	6/22/2017	Olson, Edwin S, et al.
	US-20170173557A1	6/22/2017	Olson, Edwin S, et al.
	US-20170239644A1	8/24/2017	Olson, Edwin S, et al.
	US-2,317,857	4/27/1943	Soday, Frank J
	US-2,456,272A1	2/7/2002	Pahlman, John, et al.
	US-3,194,629	7/13/1965	Dreibelbis, John A, et al.
	US-3,341,185	9/12/1967	Kennedy, Sr, Walter L
	US-3,662,523	5/16/1972	Revoir, William H, et al.
	US-3,786,619	1/22/1974	Melkersson, Karl-axel
	US-3,826,618	7/30/1974	Capuano, Italo A
	US-3,849,267	11/19/1974	Hilgen, Hendrika, et al.
	US-3,876,393	4/8/1975	Kasai, Juichi, et al.
	US-3,935,708	2/3/1976	Harrewijne, A., et al.
	US-4,094,777	6/13/1978	Sugier, Andre, et al.
	US-4,101,631	7/18/1978	Ambrosini, Ronald Frank, et al.
	US-4,196,173	4/1/1980	DeJong, Geert J, et al.
	US-4,338,896	7/13/1982	Papasideris, Stamos I.

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 3 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-4,342,192	8/3/1982	Heyn, K., et al.
	US-4,500,327	2/19/1985	Nishino, Hirosh, et al.
	US-4,530,765	7/23/1985	Sabherwal, Inderjit H
	US-4,708,853	11/24/1987	Matviya, Thomas, et al.
	US-4,772,455	9/20/1988	Izumi, Kazuo, et al.
	US-4,786,483	11/22/1988	Audeh, Costandi A
	US-4,814,152	3/21/1989	Yan, Tsoung Y
	US-4,820,318	4/11/1989	Chang, Chin-hsiung, et al.
	US-4,889,698	12/26/1989	Moller, Jens, et al.
	US-4,956,162	9/11/1990	Smith, et al.
	US-4,956,162	9/11/1990	Smith, Wallace B, et al.
	US-5,245,120	9/14/1993	Srinivasachar, Srivats, et al.
	US-5,288,306	2/22/1994	Aibe, Toshio, et al.
	US-5,300,137	4/5/1994	Weyand, Thomas E., et al.
	US-5,336,835	8/9/1994	McNamara, James D.
	US-5,346,674	9/13/1994	Weinwurm, Peter, et al.
	US-5,409,522	4/25/1995	Durham, Michael D, et al.
	US-5,419,834	5/30/1995	Straten, Gunter
	US-5,435,980	7/25/1995	Felsvang, Karsten S, et al.
	US-5,462,908	10/31/1995	Liang, Septimus -C H, et al.
	US-5,480,619	1/2/1996	Johnson, Dennis, et al.
	US-5,500,306	3/19/1996	Hsu, M. S., et al.
	US-5,505,766	4/9/1996	Chang, Ramsay
	US-5,575,982	11/19/1996	Reiss, Guenter, et al.
	US-5,607,496	3/4/1997	Brooks, Richard J
	US-5,672,323	9/30/1997	Bhat, Pervaje, et al.
	US-5,695,726	12/9/1997	Lerner, B J.
	US-5,695,726	12/9/1997	Lerner, B.
	US-5,827,352	10/27/1998	Altman, Ralph, et al.
	US-5,891,324	4/6/1999	Ohtsuka, Kiyoto
	US-6,001,762	12/14/1999	Harmer, Mark Andrew, et al.
	US-6,013,593	1/11/2000	Lee, Hoo-kun, et al.
	US-6,027,551	2/22/2000	Hwang, Jiann-Yang, et al.
	US-6,074,974	6/13/2000	Lee, Jung-min, et al.
	US-6,080,281	6/27/2000	Attia, Yosry A
	US-6,136,072	10/24/2000	Sjostrom, Sharon, et al.
	US-6,136,749	10/24/2000	Gadkaree, Kishor P, et al.

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 4 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-6,214,304	4/10/2001	Rosenthal, Jurgen, et al.
	US-6,258,334	7/10/2001	Gadkaree, Kishor, et al.
	US-6,342,462	1/29/2002	Kulprathipanja, Santi
	US-6,372,187	4/16/2002	Madden, Deborah A, et al.
	US-6,375,909	4/23/2002	Dangtran, Ky, et al.
	US-6,383,981	5/7/2002	Blankenship, Steven, et al.
	US-6,471,936	10/29/2002	Chen, Pin, et al.
	US-6,475,451	11/5/2002	Leppin, Dennis, et al.
	US-6,528,030	3/4/2003	Madden, Deborah A., et al.
	US-6,576,585	6/10/2003	Fischer, Stefan, et al.
	US-6,579,507	6/17/2003	Pahlman, John, et al.
	US-6,596,661	7/22/2003	Neufert, Ronald
	US-6,610,263	8/26/2003	Pahlman, John, et al.
	US-6,638,485	10/28/2003	Iida, Kozo, et al.
	US-6,808,692	10/26/2004	Oehr, Klaus H.
	US-6,818,043	11/16/2004	Chang, Ramsay, et al.
	US-6,848,374	2/1/2005	Srinivasachar, Srivats, et al.
	US-6,878,358	4/12/2005	Vosteen, Bernhard, et al.
	US-6,942,840	9/13/2005	Broderick, Thomas E
	US-6,953,494	10/11/2005	Nelson Jr., Sidney, et al.
	US-6,960,329	11/1/2005	Sellakumar, Kumar M.
	US-7,017,330	3/28/2006	Bellows, James C.
	US-7,081,434	7/25/2006	Sinha, Rabindra K.
	US-7,124,591	10/24/2006	Baer, Joan Mae, et al.
	US-7,211,707	5/1/2007	Axtell, Holly C, et al.
	US-7,247,279	7/24/2007	Pahlman, John, et al.
	US-7,293,414	11/13/2007	Huber, David J.
	US-7,435,286	10/14/2008	Olson, Edwin S, et al.
	US-7,435,286	10/14/2008	Olson, Edwin S., et al.
	US-7,442,239	10/28/2008	Armstrong, J. A., et al.
	US-7,479,263	1/20/2009	Chang, Shih-ger, et al.
	US-7,514,052	4/7/2009	Lissianski, Vitali Victor, et al.
	US-7,521,032	4/21/2009	Honjo, Shintaro, et al.
	US-7,544,338	6/9/2009	Honjo, S., et al.
	US-7,563,311	7/21/2009	Graham, James R
	US-7,611,564	11/3/2009	Mcchesney, Joe, et al.
	US-7,622,092	11/24/2009	Honjo, S., et al.

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 5 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-7,722,843	5/25/2010	Srinivasachar, S.
	US-7,767,174	8/3/2010	Lui, K., et al.
	US-7,780,765	8/24/2010	Srinivasachar S., et al.
	US-7,938,571	5/10/2011	Irvine, James H
	US-7,942,566	5/17/2011	Irvine, James H
	US-8,007,749	8/30/2011	Chang, Shih-ger, et al.
	US-8,080,088	12/20/2011	Srinivasachar, Srivats
	US-8,168,147	5/1/2012	Olson, Edwin S, et al.
	US-8,168,149	5/1/2012	Gal, Eli, et al.
	US-8,173,566	5/8/2012	Olson, Edwin S, et al.
	US-8,216,535	7/10/2012	Pollack, Nicholas R, et al.
	US-8,512,655	8/20/2013	Olson, Edwin S, et al.
	US-8,652,235	2/18/2014	Olson, Edwin S, et al.
	US-8,821,819	9/2/2013	Olson, Edwin S, et al.
	US-9,011,805	4/21/2015	Olson, Edwin S, et al.
	US-9,468,886	10/18/2016	Olson, Edwin S, et al.
	US-9,662,629	5/30/2017	Olson, Edwin S, et al.
	US-9,669,355	6/6/2017	Olson, Edwin S, et al.
	US-9,757,689	9/12/2017	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
	CA-1099490A	4/21/1981	DeJong, Geert, et al.	
	CA-2150529A1	12/29/1995	Scherer, Volker, et al.	
	CA-2327602A1	6/6/2001	Robles, Antonio	
	CA-2400898A1	8/30/2001	Maes, Rudy J, et al.	
	CA-2584327A1	4/13/2006	Pavlish, John H, et al.	
	CA-2757309A1	10/28/2010	Olson, Edwin S, et al.	
	CA-2757309C	1/3/2017	Olson, Edwin S, et al.	
	CN-101048218A	10/3/2007	Olson, Edwin S, et al.	
	CN-101053820A	10/17/2007	Geng, Jianming Qian	
	CN-101293196A	10/29/2008	Zhenglong, Yang	
	CN-101816922A	9/1/2010	Song, Hu, et al.	
	CN-102413899A	4/11/2012	Olson, Edwin S, et al.	
	CN-104519410A	4/15/2015	Olson, Edwin S., et al.	

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 6 of 19	Attorney Docket No: 4820.007US4	

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	CN-104619410B	5/4/2016	Olson, Edwin S, et al.	
	CN-1048173A	1/2/1991	Guoguan, et al.	
	CN-105188910A	12/23/2015	Olson, Edwin S.	
	CN-107661744A	2/6/2018	Olson, Edwin S, et al.	
	DE-10233173A1	2/12/2004	Vosteen, Bernhard, et al.	
	DE-202012003747U1	11/15/2012		
	DE-3426059A1	1/16/1986	Seipenbusch, Jurgen, et al.	
	DE-3816600A1	11/23/1989	Kaizik, Alfred, Dr., et al.	
	EP-0208490A1	1/14/1987	Moller, Jens Thousig, et al.	
	EP-1386655A1	2/4/2004	Vosteen, Vosteen Bernhard, et al.	
	EP-1458474	9/22/2004	Hammel, Charles F, et al.	
	EP-1570894A1	9/7/2005	Lissianski, V. V.	
	FR-2529802	1/13/1984	Pelosi, J., et al.	
	GB-2122916A	1/25/1984	Nishino, Hiroshi, et al.	
	JP-09256812	9/30/1997	Masanori, K., et al.	
	JP-4943197B4	11/19/1974	Yokota, Noriyuki, et al.	
	JP-4953590A	5/24/1974		
	JP-4953593A	5/24/1974		
	JP-4966592A	6/27/1974		
	JP-50145324A	3/3/1980		
	JP-506438B4	3/13/1975	Yokota, Noriyuki, et al.	
	JP-51003386A	1/12/1976	Soya, Kensuke, et al.	
	JP-544868A	1/13/1979	Seki, Michiharu, et al.	
	KR-1020027006149	7/2/2002	Tsuyoshi, O., et al.	
	SU-1163982A	6/30/1985	Belozerov, I. M.	
	SU-732207A1	5/5/1980	Valueva, Svetlana P, et al.	
	WO-0162368A1	8/30/2001	Maes, Rudy J, et al.	
	WO-0228513A2	4/11/2002	Pahlman, John E, et al.	
	WO-03072241A1	9/4/2003	Hammel, Charles F, et al.	
	WO-2004089501A2	10/21/2004	Mazyck, D. W., et al.	
	WO-2004094024A2	11/4/2004	Olson, Edwin, et al.	
	WO-2006039007A2	4/13/2006	Olson, Edwin S, et al.	
	WO-2006039007A3	4/13/2006	Olson, Edwin S, et al.	
	WO-2006099611A1	9/21/2006	Comrie, Douglas C, et al.	
	WO-2009018539A3	2/5/2009	Schmidt, Darren D.	
	WO-2010123609A1	10/28/2010	Olson, Edwin S, et al.	
	WO-2013162968A2	10/31/2013	Olson, Edwin S, et al.	

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 7 of 19	Attorney Docket No: 4820.007US4	

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	WO-2013162968A3	10/31/2013	Olson, Edwin, et al.	
	WO-2014137907A2	9/12/2014	Olson, Edwin S, 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. 10/554,018 Response filed 11-01-10 to Final Office Action mailed 04-27-10", 17 pgs	
	"Application Serial No. 10/554,018, Final Office Action mailed 04-27-10", 8 pgs	
	"Application Serial No. 10/554,018, Non Final Office Action mailed 10-06-09", 8 pgs	
	"Application Serial No. 10/554,018, Notice of Allowance mailed 01-19-12", 7 pgs	
	"Application Serial No. 10/554,018, Response filed 02-08-10 to Non Final Office Action mailed 10-06-09", 9 pgs	
	"Application Serial No. 10/554,018, Response filed 08-10-09 to Restriction Requirement mailed 06-09-09", 1 pg	
	"Application Serial No. 10/554,018, Restriction Requirement mailed 06-09-09", 5 pgs	
	"Application Serial No. 11/209,163, Advisory Action mailed 04-21-08", 3 pgs.	
	"Application Serial No. 11/209,163, Final Office Action mailed 01-23-08", 20 pgs	
	"Application Serial No. 11/209,163, Non Final Office Action mailed 08-13-07", 14 pgs.	
	"Application Serial No. 11/209,163, Notice of Allowance mailed 07-14-08", 7 pgs	
	"Application Serial No. 11/209,163, Preliminary Amendment filed 02-27-07", 9 pgs	
	"Application Serial No. 11/209,163, Response filed 03-24-08 to Final Office Action mailed 01-23-08", 29 pgs	
	"Application Serial No. 11/209,163, Response filed 07-09-07 to Restriction Requirement mailed 06-07-07", 2 pgs	
	"Application Serial No. 11/209,163, Response filed 11-13-07 to Non Final Office Action mailed 08-13-07", 19 pgs	
	"Application Serial No. 11/209,163, Restriction Requirement mailed 06-07-07", 6 pgs	
	"Application Serial No. 12/184,860, Examiner Interview Summary mailed 04-05-11", 3 pgs	
	"Application Serial No. 12/184,860, Final Office Action mailed 05-11-11", 15 pgs	
	"Application Serial No. 12/184,860, Non Final Office Action mailed 01-19-11", 14 pgs	
	"Application Serial No. 12/184,860, Response filed 04-07-11 to Non Final Office Action mailed 01-19-11", 12 pgs	
	"Application Serial No. 12/184,860, Response filed 07-08-11 to Final Office Action mailed 05-11-11", 11 pgs	
	"Application Serial No. 12/201,595, Final Office Action mailed 03-10-10", 13 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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 8 of 19	Attorney Docket No: 4820.007US4	

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.	
	"Application Serial No. 13/427,665, Non Final Office Action mailed 08-03-12", 12 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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 9 of 19	Attorney Docket No: 4820.007US4	

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. 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	
	"Application Serial No. 13/427,665, Response filed 10-10-12 to Non Final Office Action mailed 08-03-12", 15 pgs	
	"Application Serial No. 13/427,685, Preliminary Amendment filed 03-22-12", 3 pgs	
	"Application Serial No. 13/453,274, Advisory Action mailed 11-24-14", 3 pgs	
	"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.	
	"Application Serial No. 13/966,768, Response filed 03-06-14 to Non Final Office Action mailed 12-06-13", 6 pgs.	
	"Application Serial No. 13/966,768, Supplemental Preliminary Amendment filed 08-15-13", 6 pgs.	
	"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	

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 10 of 19	Attorney Docket No: 4820.007US4	

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. 14/195,360, Non Final Office Action mailed 06-20-16", 11 pgs	
	"Application Serial No. 14/195,360, Non Final Office Action mailed 06-20-16", 11 pgs	
	"Application Serial No. 14/195,360, Non Final Office Action mailed 11-24-15", 19 pgs	
	"Application Serial No. 14/195,360, Notice of Allowance mailed 02-07-17", 5 pgs	
	"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	
	"Application Serial No. 14/712,558, Non Final Office Action mailed 07-06-17", 7 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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 11 of 19	Attorney Docket No: 4820.007US4	

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, Response filed 01-23-18 to Final Office Action mailed 12-06-17", 13 pgs	
	"Application Serial No. 14/712,558, Response filed 04-02-18 to Final Office Action mailed 12-06-17", 7 pgs.	
	"Application Serial No. 14/712,558, Response filed 10-06-17 to Non Final Office Action mailed 07-06-17", 12 pgs	
	"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.	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 02-21-18", 15 pgs	
	"Application Serial No. 15/589,359, Preliminary Amendment filed 01-03-18", 6 pgs	
	"Application Serial No. PCT/US04/12828, International Search Report mailed 10/22/2004", 2 pgs	
	"Application Serial No. PCT/US2014/019916, International Preliminary Report on Patentability mailed 09-17-15", 14 pgs	
	"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	
	"Canadian Application Serial No. 2,523,132, Office Action mailed 07-18-11", 3 pgs	
	"Canadian Application Serial No. 2,523,132, Response filed 01-16-12 to Office Action mailed 7-18-11", 5 pgs	
	"Canadian Application Serial No. 2,584,327, Office Action mailed 03-03-09", 4 pgs.	
	"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	

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

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 12 of 19	Attorney Docket No: 4820.007US4	

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
	"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	
	"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 04-24-18", 4 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	

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 13 of 19	Attorney Docket No: 4820.007US4	

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
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 12-23-16", 24 pgs.	
	"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.	
	"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	

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

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 14 of 19	Attorney Docket No: 4820.007US4	

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
	"European Application Serial No. 10767465.7, Intention to Grant mailed 03-17-14", 44 pgs	
	"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	
	"European Application Serial No. 11189252.7, Office Action mailed 12-11-13", 6 pgs	
	"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	
	"European Application Serial No. 11189252.7, Response filed 10-10-13 to Office Action mailed 04-15-13", 18 pgs	
	"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	
	"European Application Serial No. 13719338.9, Office Action mailed 12-19-14", 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

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 15 of 19	Attorney Docket No: 4820.007US4	

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
	"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	
	"European Application Serial No. 14711106.6, Response filed 08-17-17 to Communication Pursuant to Article 94(3) EPC mailed 02-22-17", 10 pgs	
	"International Application No. PCT/US2008/071986, International Search Report mailed 01-30-09", 3 pgs	
	"International Application Serial No. PCT/US2005/030018, International Preliminary Report on Patentability mailed 12-27-06", 3 pgs	
	"International Application Serial No. PCT/US2005/030018, International Search Report mailed 07-25-06", 2 pgs	
	"International Application Serial No. PCT/US2005/030018, Written Opinion mailed 07-25-06", 3 pgs	
	"International Application Serial No. PCT/US2010/022807, International Preliminary Report on Patentability mailed 11-03-11", 6 pgs	
	"International Application Serial No. PCT/US2010/022807, International Search Report mailed 09-13-10", 3 pgs	
	"International Application Serial No. PCT/US2010/022807, Written Opinion mailed 09-13-10", 4 pgs	
	"International Application Serial No. PCT/US2013/036964, International Preliminary Report on Patentability mailed 07-17-14", 11 pgs	
	"International Application Serial No. PCT/US2013/036964, International Search Report mailed 11-29-13", 7 pgs	
	"International Application Serial No. PCT/US2013/036964, Invitation to Pay Additional Fees and Partial Search Report mailed 08-02-13", 7 pgs	
	"International Application Serial No. PCT/US2013/036964, Written Opinion mailed 04-15-14", 10 pgs	
	"International Application Serial No. PCT/US2013/036964, Written Opinion mailed 11-29-13", 13 pgs	
	"International Application Serial No. PCT/US2014/019916, International Search Report mailed 10-13-14", 6 pgs.	
	"International Application Serial No. PCT/US2014/019916, Invitation to Pay Additional Fees and Partial Search Report mailed 05-30-14", 6 pgs	
	"International Application Serial No. PCT/US2014/019916, Written Opinion mailed 10-13-14", 13 pgs.	
	"Powdered Activated Carbon", Cabot Corp, [Online] retrieved from the internet: <http://www.cabotcorp.com/solutions/products-plus/activated-carbon/powdered>, (01/03/15), 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

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 16 of 19	Attorney Docket No: 4820.007US4	

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
	"Response filed 09-04-17 to Notification Regarding Rule 164 and Article 94(3) EPC mailed 04-24-17", 7 pgs	
	ARENILLAS, A, et al., "CO2 removal potential of carbons prepared by co-pyrolysis of sugar and nitrogen containing compounds", Journal of analytical and applied pyrolysis 74.1, (2005), 298-306	
	BAKANDRITSOS, A., et al., "Aqueous and Gaseous Adsorption from Montmorillonite-Carbon Composites and from Derived Carbons", Langmuir, 21, (2005), 2349-2355	
	BAKANDRITSOS, A., et al., "High Surface Area Montmorillonite - Carbon Composites and Derived Carbons", Chemistry of Materials, Vol. 16, No. 8, (16 March 2004), 1551-1559	
	BIMER, JAN, et al., "Modified active carbons from precursors enriched with nitrogen functions: sulfur removal capabilities", (1998), 519-525	
	CHANG, SHIH-GER, "METHOD FOR OXIDATION OF MERCURY VAPOR", Provisional Application Serial No. 60/560,904, filed April 9, 2004, (04/09/04), 9 pgs.	
	CRISWELL, GORDON, et al., "Progress Report on Mercury Control Retrofit at the Colstrip Power Station", Paper #91, Mega Symposium, Baltimore, MD, (August 2011), 1-23	
	DARDER, M., et al., "Caramel-clay nanocomposites", Journal of Materials Chemistry, 15, (2005), 3913-3918	
	DIAMANTOPOULOU, LR G SKODRAS, et al., "Sorption of mercury by activated carbon in the presence of flue gas components", Fuel Processing Technology 91.2, (2010), 158-163	
	DONG, J., et al., "Mercury Removal from Flue Gases by Novel Regenerable Magnetic Nanocomposite Sorbents", Environ. Sci. Technol., 43, (2009), 3266-3271	
	DUNHAM, G. E., et al., "Mercury Capture by an Activated Carbon in a Fixed-Bed Bench-Scale System", Environmental Progress, 17(3), (1998), 203-208	
	EISAZADEH, H,, "Removal of Mercury from Water Using Polypyrrole and its Composites", Chinese Journal of Polymer Science, 25(4), (2007), 393-397	
	FELSVANG, K., et al., "Mercury Reduction and Control Options", The U.S. EPA-DOE-EPRI Combined Power Plant Air Pollutant Control Symposium; The Mega Symposium and The A&WMA Specialty Conference and Mercury Emissions: Fate, Effects and Control; Chicago, IL, (August, 2001), 1-19	
	FERNANDEZ-SAAVEDRA, R., et al., "Polymer-Clay Nanocomposites as Precursors of Nanostructured Carbon Materials for Electrochemical Devices: Templating Effect of Clays", Journal of Nanoscience and Nanotechnology, 8, (2008), 1741-1750	
	GHORBANI, M., et al., "Application of polyaniline nanocomposite coated on rice husk ash for removal of Hg(II) from aqueous media", Synthetic Metals, (2001), 4 pgs.	
	GHORISHI, BEHROOZ, et al., "Sorption of Mercury Species by Activated Carbons and Calcium-Based Sorbents: Effect of Temperature, Mercury Concentration and Acid Gases", Waste Manage. Res., 16:6, (1998), 582-593	
	GOMEZ-AVILES, A., et al., "Functionalized Carbon-Silicates from Caramel-Sepiolite Nanocomposites", Angew. Chem. Int. Ed., 46, (2007), 923-925	

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

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 17 of 19	Attorney Docket No: 4820.007US4	

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	
	HA, et al., "Effect of unburnt carbon on the corrosion performance of fly ash cement mortar", Construction and Building Materials, (09/01/2005), 7 pgs	
	IKEUE, K., et al., "Noble-metal-containing nanoporous carbon synthesized within the interlayer space of montmorillonite and its catalytic property", Applied Catalysis A: General, 351, (2008), 68-74	
	KAWABUCHI, YUJI, et al., "Chemical vapor deposition of heterocyclic compounds over active carbon fiber to control its porosity and surface function", Langmuir 13.8, (1997), 2314-2317	
	KYOTANI, T., et al., "Formation of highly orientated graphite from polyacrylonitrile by using a two-dimensional space between montmorillonite lamellae", Nature, 331, (1988), 331-333	
	LANCIA, A., et al., "Adsorption of Mercuric Chloride Vapours from Incinerator Flue Gases on Calcium Hydroxide Particles", Combust. Sci. & Tech., 93, (1993), 277-289	
	LAUMB, JASON D., et al., "X-ray photoelectron spectroscopy analysis of mercury sorbent surface chemistry", Fuel Processing Technology, 85, (2004), 577-585	
	LI, Y., et al., "Removal of elemental mercury from simulated coal-combustion flue gas using a SiO2-TiO2 nanocomposite", Fuel Processing Technology, 89, (2008), 567-573	
	M, HOCQUEL, "Quecksilber und seine Verbindungen bei der Abfallverbrennung", with English Abstract pg 3, (12/31/2000), 112 pgs	
	MAROTO-VALER, M. MERCEDES, et al., "DEVELOPMENT OF ACTIVATED CARBONS FROM COAL AND BIOMASS COMBUSTION AND GASIFICATION CHARS", (2004), 2 pgs	
	MOCHIDA, I., et al., "Preparation of nitrogen containing pitches from quinoline and isoquinoline by AID of AlCl3", Carbon, 33(8), (1995), 1069-1077	
	NGUYEN-THANH, D., et al., "High Porosity Carbonaceous Adsorbents Templated From Porous Clay Heterostructures", Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem., 51(1), (2006), 7-8	
	NGUYEN-THANH, D., et al., "Metal-loaded carbonaceous adsorbents templated from porous clay heterostructures", Microporous and Mesoporous Materials, 92, (2006), 47-55	
	NICKELS, DALE L, et al., "Processing and reuse of activated carbon used to adsorb mercury from power plant flue gases", Final report, (2004)	
	OLSON, DAVID, et al., "The reduction of gas phase air toxics from combustion and incineration sources using the MET-Mitsui-BF activated coke process", Fule Processing Technology, (2000), 13 pgs	
	OLSON, DAVID G., et al., "The Reduction of Gas Phase Air Toxics from Combustion and Incineration Sources using the MET-Mitsui-BF Activated Coke Process", Fuel Processing Technology, 65-66, (2000), 393-405	
	OLSON, E. S., et al., "Catalytic effects of carbon sorbents for mercury capture", Journal of Hazardous Materials, 74, (2000), 61-79	

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 18 of 19	Attorney Docket No: 4820.007US4	

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	
	PADAK, BIHTER, "Understanding mercury binding on activated carbon", Carbon 47.1 2, (2009), 2855-2864	
	PRZEPIORSKI, J, et al., "High temperature ammonia treatment of activated carbon for enhancement of CO2 adsorption", Applied Surface Science 225.1, (2004), 235-242	
	RACHEL, RIBEIROVIEIRA AZZI RIOS, et al., "Tailoring Activated Carbon by Surface Chemical Modification with O, S, and N Containing Molecules", Materials Research. 6 (2), (2003), 129-135	
	RAYMUNDO-PINERO, E, et al., "Structural characterization of N-containing activated carbon fibers prepared from a low softening point petroleum pitch and a melamine resin", Carbon 40.4, (2002), 597-608	
	SMOKEY, et al., "Alternative to Activated Carbon for Mercury Control", Power Engineering, (Oct 2012), 10 pgs	
	STRENG, SABINE, et al., "Toxics control by activated charcoal within the "System Dusseldorf" full scale experience", B. Fuel Processing Technology, (1994), 14 pgs	
	TSUJI, K, et al., "The Activated Coke Process for Combinded SOx/NOx/Air Toxics Reduction", Air and Water Management Assoc., (March 10, 1993), 27 pgs	
	VOSTEEN, B, et al., "Chlor-und Bromgestutzte Hg-Sorption an Elektrofilter-Flugaschen eines kohlegefeuerten Schmelzkammerkessels und an Zementrohmehl", Matin-Luther-Universitat Halle-Wittenberg, (2003), 1-30	
	VOSTEEN, B. W., et al., "", Flyer on Mercury Abatement given at the VDI-Wissensforum, Dusseldorf,Germany, (2003), 6 pgs.	
	VOSTEEN, B. W., "Bromine-enhanced Mercury Abatement from Combustion Flue Gases - Recent Industrial Applications and Laboratory Research", VGB PowerTech, Vol. 86, Issue 3/2006, (2006), 70-75	
	VOSTEEN, N., "Emissionsminderung von Quecksilber durch chlor- und bromgestutzte Hg-Oxidation in Rauchgas", (September 2003), 1-23	
	WAN, Q., et al., "Removal of gaseous elemental mercury over a CeO2-WO3/TiO2 nanocomposite in simulated coal-fired flue gas", Chemical Engineering Journal, 170, (2011), 512-517	
	WANG, B., et al., "Performance of a diatomite-based sorbent in removing mercury from aqueous and oil matrices", J. Environ. Eng. Sci., 6, (2007), 469-476	
	ZHANG, Y., et al., "High efficient removal of mercury from aqueous solution by polyaniline/humic acid nanocomposite", Journal of Hazardous Materials, 175, (2010), 404-409	
	ZHAO, YONGXIN, et al., "Effectsof Sulfur Dioxide and Nitric Oxide on Mercury Oxidation and Reducton under Homogeneous Conditions", J. Air & Waste Manage. Assoc., 56, (2006), 628-635	

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 19 of 19	Attorney Docket No: 4820.007US4	

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**
	ZHENG, YUANJING, et al., "Review of technologies for mercury removal from flue gas from cement production processes", Progress in Energy and Combustion Science, Vol. 38, No. 5, (26 April 2012), 599-629	
	ZHU, JIANZHONG, et al., "Enhanced mercury ion adsorption by amine-modified activated carbon", Journal of hazardous materials 166, (2009), 866-872	

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 Acknowledgement Receipt

EFS ID:	32660200
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	18-MAY-2018
Filing Date:	
Time Stamp:	10:54:59
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		15978760_IDS_5-17-2018.pdf	572425 f662d75ddff8a679fb89b79e6d33e12abbdd89df	yes	24

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Miscellaneous Incoming Letter	1	1
	Miscellaneous Incoming Letter	2	3
	Transmittal Letter	4	5
	Information Disclosure Statement (IDS) Form (SB08)	6	24

Warnings:					
Information:					
2	Foreign Reference	0001_ca1099490a.pdf	1170724 b11d1377e6ca351371a121a10e65410a427c4b73	no	11
Warnings:					
Information:					
3	Foreign Reference	0002_ca2150529a1.pdf	2630508 99d1abe34540adeaf9fada4e339d3e12fba388a8	no	25
Warnings:					
Information:					
4	Foreign Reference	0003_ca2327602a1.pdf	2123411 d84dae618783d5d7f1a4118ae668eb1ea3635db0	no	23
Warnings:					
Information:					
5	Foreign Reference	0004_ca2400898a1.pdf	1395134 c97388dfd2ebd2ac0ed471048cb3526efaccc7d5	no	14
Warnings:					
Information:					
6	Foreign Reference	0005_ca2584327a1.pdf	6083076 8149e72c5037256caaf1b976d63664091a8594d5	no	45
Warnings:					
Information:					

7	Foreign Reference	0006_ca2757309a1.pdf	5867128 86ac2e68939d4e9607e2a4488279e5cc606b1e62	no	40
Warnings:					
Information:					
8	Foreign Reference	0007_ca2757309c.pdf	6156461 0cd64894be75423c97eb25b58724d4b5307b7f6d	no	46
Warnings:					
Information:					
9	Foreign Reference	0008_cn101048218a.pdf	6922893 2d691fe366654fbf1d72568153c99fe7417d9b14	no	48
Warnings:					
Information:					
10	Foreign Reference	0009_cn101053820a.pdf	2273309 6e1072a2153959f9ec1e12f6ab6765139cba0087	no	13
Warnings:					
Information:					
11	Foreign Reference	0010_cn101293196a.pdf	1966132 e1aa751d621f83ead9745b23436422001c972dea	no	10
Warnings:					
Information:					
12	Foreign Reference	0011_cn_101816922a.pdf	1516433 e15646aa562607958306 9dfbf834b0132a2b9752	no	7
Warnings:					
Information:					
13	Foreign Reference	0012_cn102413899a.pdf	5270955 6dcb295ae9c2ca6c4ebd7c6648c898bbb3c3cba2	no	28
Warnings:					
Information:					

14	Foreign Reference	0013_cn104519410a.pdf	6552360 1031260d094ed255a9cdc6cc9d2d31a39aac68db	no	36
Warnings:					
Information:					
15	Foreign Reference	0014_cn104619410b.pdf	6086688 797cab8a72d7be606650dada84910b645a49a2f3	no	34
Warnings:					
Information:					
16	Foreign Reference	0015_cn1048173a.pdf	1031511 25f020660e44db839bd821599ba231f1e2ae0424	no	8
Warnings:					
Information:					
17	Foreign Reference	0016_cn105188910a.pdf	701884 5f9b5a9a2c93f524f87947476c9561ddaecbc19d	no	32
Warnings:					
Information:					
18	Foreign Reference	0017_cn107661744a.pdf	773317 3e92077a925c962bc259fd122bb83fdcfb301a90	no	31
Warnings:					
Information:					
19	Foreign Reference	0018_de_10233173a1.pdf	7092482 9ee666e5eee7fe86e03ce4a21093219608d44696	no	22
Warnings:					
Information:					
20	Foreign Reference	0019_de_202012003747u1.pdf	17736678 a8ac82dab8cca6bb0e59385100faee0e26520ff8	no	94
Warnings:					
Information:					

21	Foreign Reference	0020_de_3426059a1.pdf	2286874 8a3fa569fbb7046ece8e06b692d64836a5759de1	no	11
Warnings:					
Information:					
22	Foreign Reference	0026_fr_2529802a1.pdf	4362318 5e0f2ec9daa0c3a8d4f4a2ed4edc5b104029bf5f	no	21
Warnings:					
Information:					
23	Foreign Reference	0027_gb2122916a.pdf	2775270 19d3d72431b7292cd44f37770aa087a07a1b8fb6	no	20
Warnings:					
Information:					
24	Foreign Reference	0028_jph09256812a.pdf	575391 e818237ef3fa2686e6453a0da034036bfe818748	no	7
Warnings:					
Information:					
25	Foreign Reference	0029_jp4943197.pdf	510569 446ddf1f652da5cf3e7e1353528e7267697719c0	no	4
Warnings:					
Information:					
26	Foreign Reference	0030_jp_49_053590a.pdf	1148841 24c5806bce2060b4fbaab73f7a0a072624dac880	no	7
Warnings:					
Information:					
27	Foreign Reference	0031_jp_49_066592a.pdf	906901 2c3b5b923373f46af80bf475de83c6fe4aac10c3	no	5
Warnings:					
Information:					

28	Foreign Reference	0032_jps50145324a.pdf	1398450 f44d5aaa47915b69e469c923265b9c8fa75465fb	no	9
Warnings:					
Information:					
29	Foreign Reference	0033_jp506438.pdf	548269 78edf20a53d53209f7e2e63862cfeb364272d985	no	4
Warnings:					
Information:					
30	Foreign Reference	0034_jp_51_003386a.pdf	1196928 ed55c8f5bf01f8e60294f8575f15d7635ab0461e	no	8
Warnings:					
Information:					
31	Foreign Reference	0035_jps544868a.pdf	1030186 028b5439271b0f34add2b4da0705a0159d6be6fe	no	6
Warnings:					
Information:					
32	Foreign Reference	0036_kr20027006149a.pdf	406090 6a478b17fa6f8a5791f617c299c406ba64b5f8d9	no	15
Warnings:					
Information:					
33	Foreign Reference	0037_su_1163892a.pdf	636181 b995b79f223f09cf1a95eb271ce37daffa14fbfe	no	5
Warnings:					
Information:					
34	Foreign Reference	0038_su732207a1.pdf	727300 d787b11a2670390415d74426928e9bf8ee6b78e2	no	11
Warnings:					
Information:					

35	Foreign Reference	0039_wo2001062368a1.pdf	1843357 199c03baa5d960a63ef396e711ce1d77c737183b	no	14
Warnings:					
Information:					
36	Foreign Reference	0040_wo2002028513a2.pdf	12608178 eb74411dc39e31a32995871ab0c7aa97aca2cec9	no	88
Warnings:					
Information:					
37	Foreign Reference	0041_wo2003072241a1.pdf	8393493 30773d94e8bf815b25fcbfd8ef375e8aaa3dba31	no	59
Warnings:					
Information:					
38	Foreign Reference	0042_wo_2004_089501a2.pdf	6205269 423726a244424809fb32fd44bb4338b38f44cce0	no	28
Warnings:					
Information:					
39	Foreign Reference	0043_wo2004094024a2.pdf	2894624 c7d8b1a44dda0a95fe42ace40996086f4484509a	no	26
Warnings:					
Information:					
40	Foreign Reference	0044_wo2006039007a2.pdf	6253971 be13198898ed4e63bc7bc3d2345c9b6c800cbaf6	no	41
Warnings:					
Information:					
41	Foreign Reference	0045_wo2006039007a9.pdf	5793496 d9f7fa0b6b4b2571116d9bfdf80ead2b0fb89c3f	no	42
Warnings:					
Information:					

42	Foreign Reference	0046_wo2006099611a1.pdf	9403943 1d6db54a846ac499cca708c697ba171709e27721	no	64
Warnings:					
Information:					
43	Foreign Reference	0047_wo2009018539a3.pdf	379545 e92d5729aba42ed8a6d81e7187679390428efd99	no	3
Warnings:					
Information:					
44	Foreign Reference	0048_wo2010123609a1.pdf	5656804 3d10a8ec8440a8e0220e12709aec77d249ad76a0	no	41
Warnings:					
Information:					
45	Foreign Reference	0049_wo2013162968a2.pdf	6839482 de0b4a6cb7f8a69b7131bc15a4c33b4b97bf019e	no	64
Warnings:					
Information:					
46	Foreign Reference	0050_wo2013162968a3.pdf	759292 07742486752578c82dde4b4e68a500d9e0a4a114	no	8
Warnings:					
Information:					
47	Foreign Reference	0051_wo2014137907a2.pdf	6927671 8cecc03dbc2337fef66e409259128d2766d135b3	no	62
Warnings:					
Information:					
48	Foreign Reference	0052_3338013us1_aarn_110110.pdf	1683171 ae93d41b890dc6c98e68ca8b3f258d3ac48f00a8	no	17
Warnings:					
Information:					

49	Non Patent Literature	0053_3338013us1_foar_042710.pdf	604959 afade289855307aa76b211fc9cfc1001859c1014	no	8
Warnings:					
Information:					
50	Non Patent Literature	0054_3338013us1_oarn_100609.pdf	643797 1abde79f91d460d57e0f02aa67b255f40b0c3da3	no	8
Warnings:					
Information:					
51	Non Patent Literature	0055_10554018_noar_011912.pdf	915937 329e79647885d5200b6bebeaa1171276f79de3fe	no	7
Warnings:					
Information:					
52	Non Patent Literature	0056_3338013us1_aarn_020810.pdf	705845 be6d4b3f2ab04d8e0d89a6a9959ed5d91e6b4ef0	no	9
Warnings:					
Information:					
53	Non Patent Literature	0057_3338013us1_rerr_r_081009.pdf	81919 c4d0918ff67e728bd6156fd3cc4d6c7eba55b3a3	no	1
Warnings:					
Information:					
54	Non Patent Literature	0058_3338013us1_rerr_060909.pdf	417946 80f1167daea4aef4c0b02fc1a2b9f607712cdbde	no	5
Warnings:					
Information:					
55	Non Patent Literature	0059_advisory_action_04_21_08.pdf	835791 88f145a5861d17d53822e0aff0eff6f3a7bf1158	no	3
Warnings:					
Information:					

56	Non Patent Literature	0060_final_oa_01_23_2008.pdf	5840947 d5093d25268d5e716d6c6fefccc2a3388197aa27	no	20
Warnings:					
Information:					
57	Non Patent Literature	0061_non_final_oa_08_13_07.pdf	4408721 66ece423b3ce61788a176ef43dc0488b4105dcdc	no	14
Warnings:					
Information:					
		Total Files Size (in bytes):	192531235		

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.:	4820.007US4	Serial No.:	15/978,760
Filed:	May 14, 2018	Due Date:	N/A
Examiner:	Unknown	Group Art Unit:	Unknown
Customer No.:	21186	Confirmation No.:	6432

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 (2 pgs.)
X Information Disclosure Statement (2 pgs.), Form 1449 (19 pgs.) Copies of Cited References (326).

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:	Unknown
Serial No.:	15/978,760	Group Art Unit:	Unknown
Filed:	May 14, 2018	Docket:	4820.007US4
Customer No.:	21186	Confirmation No.:	6432
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

14/195,360 9,669,355	March 3, 2014	4820.003US1	ACTIVATED CARBON SORBENT INCLUDING NITROGEN AND METHODS OF USING THE SAME
15/974,343	May 8, 2018	4820.001US9	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
15/589,359	May 8, 2017	4820.003US2	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
15/853,029	December 22, 2017	4820.018US1	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Respectfully submitted,

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

Date 5-17-2018 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: Unknown
Serial No.: 15/978,760	Group Art Unit: Unknown
Filed: May 14, 2018	Docket: 4820.007US4
Customer No.: 21186	Confirmation No.: 6432
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

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 5-17-2018 By /Nicholas P. Lanzatella/
Nicholas P. Lanzatella
Reg. No. 63,803

NPL:jj

Electronic Acknowledgement Receipt

EFS ID:	32660400
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	18-MAY-2018
Filing Date:	
Time Stamp:	11:06:36
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	0062_3338005us1_noar_101408.pdf	808891 957d0c1aba1bdd81b4013eeee8ba32c9e359222b	no	7

Warnings:

Information:					
2	Non Patent Literature	0063_prel_azmend_02_27_07.pdf	1998859 d69683cce97b26efe040c6e7630e600e9aeaea07	no	9
Warnings:					
Information:					
3	Non Patent Literature	0064_response_03_24_08.pdf	10172094 760e605d973e91322c005e24a854cdd72837030b	no	29
Warnings:					
Information:					
4	Non Patent Literature	0065_3338005us1_rrr_070907.pdf	120258 9d42f953d79e3ed0b59cf62d24ab00d6ab491789	no	2
Warnings:					
Information:					
5	Non Patent Literature	0066_3338005us1_aarn_111307.pdf	2255877 944f599810aa5d71e099f6904bffc74e78da18eb	no	19
Warnings:					
Information:					
6	Non Patent Literature	0067_3338005us1_rerr_060707.pdf	622880 863642dab189fb3b955f3ac4da36ac6437120538	no	6
Warnings:					
Information:					
7	Non Patent Literature	0068_3338002us1exir4511.pdf	386116 3eefdbfb75553475460c0a5f79f30c3a072ca17e	no	3
Warnings:					
Information:					
8	Non Patent Literature	0069_3338002us1_foar_051111.pdf	1752774 d7f563380b32dc8f53d2145386b3f588caf8b5bd	no	15
Warnings:					
Information:					

9	Non Patent Literature	0070_3338002us1_oarn_011911.pdf	1489183 72947579512c108ccd0babcb603881bfced90e00	no	14
Warnings:					
Information:					
10	Non Patent Literature	0071_3338002us1_aarn_040711.pdf	355854 96f37ccf5ebcc2e39b3408846eca9faf74053def	no	12
Warnings:					
Information:					
11	Non Patent Literature	0072_3338002us1_aarf_070811.pdf	95664 aa4173b908a69a1d47fcff3626a6ead178c79d51	no	11
Warnings:					
Information:					
12	Non Patent Literature	0073_final_oa_03_10_10.pdf	3671215 a97ff713957724993fd0ec8a820b58ec3be1bb2c	no	13
Warnings:					
Information:					
13	Non Patent Literature	0074_nonfinal_oa_04_16_2009.pdf	6039014 664439dc613973c9ea51e6a6f746e84417ac58b9	no	21
Warnings:					
Information:					
14	Non Patent Literature	0075_3338005us2_aarn_101609.pdf	2599100 a12264671892e09536834be37112440af790bff7	no	18
Warnings:					
Information:					
15	Non Patent Literature	0076_final_oa_10_14_10.pdf	5153942 3202d57f1b88b008fbc0be0e5f53c83b060ff500	no	17
Warnings:					
Information:					

16	Non Patent Literature	0077_non_final_oa_1_15_10.pdf	3870503 c66ec12dceb80afb02c99bc432c2ecb800e19325	no	13
Warnings:					
Information:					
17	Non Patent Literature	0078_non_final_oa_2_23_11.pdf	4995701 3df75049db4dc84e3798f970d247bc75907a1b1e	no	17
Warnings:					
Information:					
18	Non Patent Literature	0079_non_final_oa_8_4_11.pdf	4803990 cf756ffffd042e5651e71f00adb86d4cec7621a3	no	16
Warnings:					
Information:					
19	Non Patent Literature	0080_12419219__noar_011012.pdf	935300 89d49694d3f26193c83958bfb6396dd71b268250	no	7
Warnings:					
Information:					
20	Non Patent Literature	0081_3338005us3_pamd_040609.pdf	585228 5849185d5d41db8ce6defad4f0e1b79f311ed4d3	no	7
Warnings:					
Information:					
21	Non Patent Literature	0082_response_02_14_11.pdf	3929643 b1c680957a1ab2845952271c7d24d77f8e0b47f5	no	19
Warnings:					
Information:					
22	Non Patent Literature	0083_response_05_20_11.pdf	132358 7b7dcb391fa3d4f7f08da9812f9eb5ae6df16f69	no	14
Warnings:					
Information:					

23	Non Patent Literature	0084_3338005us3_aarn_071510.pdf	3249302 912a6b8581f4ae63bfcfcdea0c24510c095fec05	no	22
Warnings:					
Information:					
24	Non Patent Literature	0085_3338005us3_aarn_102711.pdf	126688 15e22070df3d91399499df55870a980609d0a853	no	12
Warnings:					
Information:					
25	Non Patent Literature	0086_5_4820007us1_adar_052912.pdf	408765 c44268b7b589052573cde0bc98ac0840fd7f28e7	no	3
Warnings:					
Information:					
26	Non Patent Literature	0087_11_4820007us1_xpqa_021413.pdf	604722 359d528ac342b8f5220b6c585ac51525e49be974	no	7
Warnings:					
Information:					
27	Non Patent Literature	0088_9_4820007us1_exir_122812.pdf	443804 da57e4fb1f8fc11ad1fae130597d08d2c9ee21ea	no	4
Warnings:					
Information:					
28	Non Patent Literature	0089_8_4820007us1_foar_103112.pdf	1986747 b15d0ff78303269084479cfb21de66ce24deea08	no	21
Warnings:					
Information:					
29	Non Patent Literature	0090_3_4820007us1_foar_122011.pdf	1928967 fe1707f56c7029c579975e4cbbdf573df7ca10f9	no	21
Warnings:					
Information:					

30	Non Patent Literature	0091_6_4820007us1_oarn_061112.pdf	1756454 dfd8a87296a739ec57543f40dbcfcd98e553abd3	no	18
Warnings:					
Information:					
31	Non Patent Literature	0092_1_4820007us1_oarn_071911.pdf	1915188 e81fe6336a1d4e1ce4e092e630c0f89f83cba21d	no	20
Warnings:					
Information:					
32	Non Patent Literature	0093_14_4820007us1_noar_011614.pdf	473567 f7f13ae391f70ce567b7563b7ef10ac5f8c65c62	no	5
Warnings:					
Information:					
33	Non Patent Literature	0094_13_4820007us1_noar_091113.pdf	1189971 1e93de589744be680c88312907e59b2f00f7dd3e	no	11
Warnings:					
Information:					
34	Non Patent Literature	0095_10_4820007us1_aarf_013113.pdf	2446056 bcc02d79a59437536126bee3421c07cc3c3fd158	no	19
Warnings:					
Information:					
35	Non Patent Literature	0096_12_4820007us1_xpqre_030713.pdf	738332 a9550bb593dc26e2530f8c25152e72ec6a8d3260	no	7
Warnings:					
Information:					
36	Non Patent Literature	0097_4_4820007us1_aarf_051112.pdf	1285857 bdb41e8a16fb0a9982e0149cb4cb7fb9382472cc	no	11
Warnings:					
Information:					

37	Non Patent Literature	0098_7_4820007us1_aarn_091112.pdf	2061960 4f8b65b325f9fc241f8cc6bcef9cbc5f34b12f7c	no	16
Warnings:					
Information:					
38	Non Patent Literature	0099_2_4820007us1_aarn_101811.pdf	2134584 c1e6c10ae083dc54531682d5ba0fd7189c362c72	no	17
Warnings:					
Information:					
39	Non Patent Literature	0100_non_final_oa_01_04_13.pdf	8931366 3755ede4827de0c9ee051b8aa972876a307bbc92	no	23
Warnings:					
Information:					
40	Non Patent Literature	0101_final_oa_08_03_12.pdf	3382371 59f4558f473296f0c6a4575a552e674020f1f513	no	12
Warnings:					
Information:					
41	Non Patent Literature	0102_3338005us4_noar_041613.pdf	936793 f19cf85a7c515931e0cfc4dc75539316467c96fb	no	8
Warnings:					
Information:					
42	Non Patent Literature	0103_3338005us4_aarn_032113.pdf	167958 b1dc38c7219f7c5e30bbbbd8bb4ecb589aea9cd2	no	20
Warnings:					
Information:					
43	Non Patent Literature	0104_response_10_10_12.pdf	109408 f1f8ee05c661282dece58ae05347ceff116631ea	no	15
Warnings:					
Information:					

44	Non Patent Literature	0105_03338005us4_pamd_032212.pdf	165681 b58a0d194aac05573aba409e0ba9493f0831d993	no	3
Warnings:					
Information:					
45	Non Patent Literature	0106_advisory_action.pdf	944995 288d24d53535e66c877f64bb1a2d54ae1574e289	no	3
Warnings:					
Information:					
46	Non Patent Literature	0107_final_oa_10_16_2014.pdf	1118523 770f102f797437e95dde936203c64f7aeac5b4e7	no	4
Warnings:					
Information:					
47	Non Patent Literature	0108_nonfinal_oa_05_30_14.pdf	2006359 29ee49cabf8b1e9a933918f640e299772649e924	no	6
Warnings:					
Information:					
48	Non Patent Literature	0109_noa_01_05_15.pdf	2591843 88707251ab0cd00c4eee9ce74ce883db46410e48	no	5
Warnings:					
Information:					
49	Non Patent Literature	0110_response_9_2_2014.pdf	131827 1f722e7268b4f6fe4a5d1a87f6090ead163fdc7a	no	13
Warnings:					
Information:					
50	Non Patent Literature	0111_amend_response_110614.pdf	82370 764f735f40665edc9105f675e80be6aa99155d73	no	7
Warnings:					
Information:					

51	Non Patent Literature	0112_response_12_9_2014.pdf	75611 4d2897306ec8c0fbd41f792214fb4f8627514479	no	6
Warnings:					
Information:					
52	Non Patent Literature	0113_nonfinal_oa_12_06_13.pdf	2944086 de667e20b3e14c5b1140a8faaaea50f0708e686a	no	7
Warnings:					
Information:					
53	Non Patent Literature	0114_noa_08_01_2014.pdf	2727722 14336818e06337b7ed0ad4a894a6110aecd0cd0a	no	6
Warnings:					
Information:					
54	Non Patent Literature	0115_noa_4_18_2014.pdf	2843974 69ffc5cef21a6e4a4ba12dba4e5da8840414dcdd	no	7
Warnings:					
Information:					
55	Non Patent Literature	0116_prel_amend_08_14_13.pdf	427085 de5fc4f17f3326f3cff726605eaed1113df298a0	no	3
Warnings:					
Information:					
56	Non Patent Literature	0117_response_3_6_2014.pdf	62917 306e39c708b29c05b4f2207c121d3e5ce7835084	no	6
Warnings:					
Information:					
57	Non Patent Literature	0118_supp_prel_amend_08_15_13.pdf	977857 b1f4b619e297fa563701f20d9f3470421f1fe06a	no	6
Warnings:					
Information:					

58	Non Patent Literature	0119_4820007us2_adar_121615.pdf	349056 e8fe35cdd5551b399ace9095f7833f41d0b24653	no	3
Warnings:					
Information:					
59	Non Patent Literature	0120_4820007us2_foar_082615.pdf	1154157 b1b5dc8fa893f8e90b464110adac77a2baa2c45d	no	12
Warnings:					
Information:					
60	Non Patent Literature	0121_4820007us2_oarn_032315.pdf	1210847 3dd21efa4a90a20cf799429c61ce807529618b1d	no	13
Warnings:					
Information:					
		Total Files Size (in bytes):	112868214		

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.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Acknowledgement Receipt

EFS ID:	32660545
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	18-MAY-2018
Filing Date:	
Time Stamp:	11:14:15
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	0122_4820007us2_noar_061016.pdf	952724 0f1c2ff74fa3bbcfafc7b8ec400873d40a15ea48	no	7

Warnings:

Information:					
2	Non Patent Literature	0123_4820007us2_adaf_012216.pdf	1435462 8bce1d845487f9609123cceb01be4bc4ac6e1355	no	11
Warnings:					
Information:					
3	Non Patent Literature	0124_4820007us2_aarn_062215.pdf	1176073 2b25b5d6e5b7402f4890885271c2b04afd06e250	no	10
Warnings:					
Information:					
4	Non Patent Literature	0125_4820007us2_aarf_112415.pdf	671167 c55f2a2b34b0413feda60d55c0cd987f33891e8e	no	5
Warnings:					
Information:					
5	Non Patent Literature	0126_3338021us1_cnoa_022717.pdf	273812 c3c410f78345a6a07e75e770646c24b9452cf36a	no	2
Warnings:					
Information:					
6	Non Patent Literature	0127_3338021us1_cnoa_032917.pdf	280720 8edcd271365c0fafaace939bb59aefe8be27736d	no	2
Warnings:					
Information:					
7	Non Patent Literature	0128_3338021us1_foar_031816.pdf	1635543 fbf04898a6cb3737d995bbc35b1595b4c30633d2	no	18
Warnings:					
Information:					
8	Non Patent Literature	0129_3338021us1_foar_112216.pdf	603828 b7ce62f995e799eb959542966b50f14ca61eb7cb	no	7
Warnings:					
Information:					

9	Non Patent Literature	0130_pages_from_14195360oarnnonfinal_office_action_received20160620.pdf	1174768 1220d068c19a2410eb8dd629c811036127c31151	no	11
Warnings:					
Information:					
10	Non Patent Literature	0131_3338021us1_oarn_062016.pdf	1021883 260e1a062d1ed003aee48a357b0601a39cdbdd8d	no	11
Warnings:					
Information:					
11	Non Patent Literature	0132_3338021us1_oarn_112415.pdf	1707154 5f1f8e0f9f500bf018062e0a0e7130f44ac83f85	no	19
Warnings:					
Information:					
12	Non Patent Literature	0133_3338021us1_noar_020717.pdf	811252 4176c07b79ef90e03f613a23cecb822ff1e714fd	no	5
Warnings:					
Information:					
13	Non Patent Literature	0134_3338021us1_aarf_011817.pdf	69508 5b2209b393f35c12a62f9ca85e4360f96e37ae93	no	7
Warnings:					
Information:					
14	Non Patent Literature	0135_3338021us1_aarn_022216.pdf	213087 0610d2040763b49df7e2408d4742b17a4a9e1cc2	no	21
Warnings:					
Information:					
15	Non Patent Literature	0136_3338021us1_aarf_051716.pdf	2065526 04ce5a988485e8f751151b852bead1327a7e4dcd	no	15
Warnings:					
Information:					

16	Non Patent Literature	0137_3338005us6_adar_021717.pdf	597838 a58a81b452f4448e271accde5b91ad8cd8b4863f	no	4
Warnings:					
Information:					
17	Non Patent Literature	0138_3338005us6_cnoa_052217.pdf	281047 57961d56ee28cde71ca775396cf2251d99084ceb	no	2
Warnings:					
Information:					
18	Non Patent Literature	0139_3338005us6_foar_112516.pdf	2451353 b380430df7d622de6618b1da28f98164d8c421ee	no	25
Warnings:					
Information:					
19	Non Patent Literature	0140_3338005us6_oarn_060216.pdf	2397871 3723e281e82cc3d0c4ef99ce3269184aaa26ac96	no	24
Warnings:					
Information:					
20	Non Patent Literature	0141_3338005us6_noar_051517.pdf	1217850 29c3490296a6be409284c45dc1b9b6dd90a55adc	no	8
Warnings:					
Information:					
21	Non Patent Literature	0142_3338005us6_aarf_012517.pdf	103971 ab2c61b9105ffba04d7b0b12357718fd31cd87e4	no	14
Warnings:					
Information:					
22	Non Patent Literature	0143_3338005us6_adaf_022717.pdf	116438 909d40d3836d63e7e25717ec093e9fabe6d879ba	no	15
Warnings:					
Information:					

23	Non Patent Literature	0144_3338005us6_rrr1mo_030216.pdf	101021 f1ad4faf5eb3b5b17e608fb189b3340e41b257ff	no	9
Warnings:					
Information:					
24	Non Patent Literature	0145_3338005us6_aarn_082216.pdf	120743 f4182910eeb7980763971a6faf88aed087237709	no	14
Warnings:					
Information:					
25	Non Patent Literature	0146_3338005us6_rerr_011416.pdf	784354 791aba7cc143cec2ab17c514e213b14e5c614914	no	8
Warnings:					
Information:					
26	Non Patent Literature	0147_3338016us2_foar_111716.pdf	462318 c610bb5146c4a3807185c8a17359572a27a136d9	no	4
Warnings:					
Information:					
27	Non Patent Literature	0148_3338016us2_oarn_071216.pdf	721711 803240aa3e0dfe9411e7f926945f9c6e7a9c78a6	no	6
Warnings:					
Information:					
28	Non Patent Literature	0149_3338016us2_noar_013017.pdf	1001440 121f24bc9bd690a1f7bef2dc296b010864788d79	no	6
Warnings:					
Information:					
29	Non Patent Literature	0150_3338016us2_pamd_121014.pdf	72723 339d1d94caa9a71fdbe146767bc8a361b2321891	no	6
Warnings:					
Information:					

30	Non Patent Literature	0151_3338016us2_rrr1mo_050616.pdf	75486 caa89404ef37e0a70ede3d88365babfb93a1b1bb	no	9
Warnings:					
Information:					
31	Non Patent Literature	0152_3338016us2_aarn_100316.pdf	1046658 cb779bf82759bdd0ed8683f42c3514a5135a0e5a	no	11
Warnings:					
Information:					
32	Non Patent Literature	0153_3338016us2_rerr_031616.pdf	617741 10073351843377e0dda35819232e7185f147b3d7	no	5
Warnings:					
Information:					
33	Non Patent Literature	0154_4820001us7_adar_021218.pdf	974668 63a98c197e0a3e70eab43ffa1f5ea59e84ea5f8b	no	8
Warnings:					
Information:					
34	Non Patent Literature	0155_4820001us7_exir_030518.pdf	290766 94862daf5e00d01305eaa621c14a637736eb914e	no	3
Warnings:					
Information:					
35	Non Patent Literature	0156_4820001us7_foar_120617.pdf	1013583 2e7e524b01ef0f83267f785b663e8c60fc5691af	no	9
Warnings:					
Information:					
36	Non Patent Literature	0157_4820001us7_oarn_070617.pdf	775280 fd0f52f85f0f9b0e016f82ab2f8b76fc604eecb	no	7
Warnings:					
Information:					

37	Non Patent Literature	0158_4820001us7_aarf_012318.pdf	1485263 9464b6fd282aaaf0e000f14d2b0a9aab07564208	no	13
Warnings:					
Information:					
38	Non Patent Literature	0159_4820001us7_aarf_040218.pdf	55119 7a0133458f944a5c15c35a883d653ad321f5a657	no	7
Warnings:					
Information:					
39	Non Patent Literature	0160_4820001us7_aarn_100617.pdf	202181 659c50c318267693f3401fd13cebd5d2ec995ab7	no	12
Warnings:					
Information:					
40	Non Patent Literature	0161_4820001us7_supamd_05152018.pdf	56217 2623ab389dcf478326aa3776428117718c9a88d6	no	6
Warnings:					
Information:					
41	Non Patent Literature	0162_4820001us7_pamd2_051515.pdf	416307 efd00879d9d9cc8a3e67e63f3faa543de58bd7ec	no	6
Warnings:					
Information:					
42	Non Patent Literature	0163_4820007us3_pamd_012617.pdf	734860 776d4d2a190f07e649ab3fd2e84984481872d33	no	8
Warnings:					
Information:					
43	Non Patent Literature	0164_4820007us3_pamd_061317.pdf	61687 fd278ba50b6284239ac1a49c6bb77f3a44bb2fa5	no	7
Warnings:					
Information:					

44	Non Patent Literature	0165_3338031us1_pamd_040417.pdf	48473 c0656598859c41ae4c91ee545d7bbba1e871c281	no	3
Warnings:					
Information:					
45	Non Patent Literature	0166_4820005us1_adar_04242018.pdf	392838 a37e22d350de1d87c16c5b64c8e87c4e36dd1770	no	3
Warnings:					
Information:					
46	Non Patent Literature	0167_4820005us1_foar_021518.pdf	1325347 6161ac4abb28908b4569d6f46551cfdd9129573f	no	13
Warnings:					
Information:					
47	Non Patent Literature	0168_4820005us1_oarn_092717.pdf	1793028 df30b60ff14f0d3c96c5467f9b2536eb44c2dd47	no	17
Warnings:					
Information:					
48	Non Patent Literature	0169_4820005us1_aarn_011618.pdf	116275 4a5b2f5828b10222360e85e78d79eab10da9b479	no	16
Warnings:					
Information:					
49	Non Patent Literature	0170_4820005us1_aarf_051418.pdf	101481 87c7b7b64b3b5636024a2fd05f0d87b1c5fe3cae	no	13
Warnings:					
Information:					
50	Non Patent Literature	0171_4820005us1_aarf_040618.pdf	101842 b4bd81341834a3e4c66026b83bbd48e0fa9c32ca	no	13
Warnings:					
Information:					

51	Non Patent Literature	0172_3338016us3_pamd_030817.pdf	44183 00152a56db68ce605ff4c783cb254e4cf066fe85	no	3
Warnings:					
Information:					
52	Non Patent Literature	0173_4820003us2_oarn_022118.pdf	1546666 18c20bb3651da39c63d1a5e795c42a34e2677617	no	15
Warnings:					
Information:					
53	Non Patent Literature	0174_4820003us2_pamd_010318.pdf	42503 2e190532936aad12e657af16a79ffd4857147a2a	no	6
Warnings:					
Information:					
54	Non Patent Literature	0175_3338013wo1.pdf	233605 72e14ae17c6945b31486ecff9267ec188904dcd7	no	2
Warnings:					
Information:					
55	Non Patent Literature	0176_3338021wo1_p326_091715.pdf	1749333 8d316f3d0b4d047f06e95f39b31e2a74ec43b4e7	no	14
Warnings:					
Information:					
56	Non Patent Literature	0177_3338021us1_aarn_091616.pdf	109499 533369de14d634d2de527087906ffb6cc76a4911	no	12
Warnings:					
Information:					
57	Non Patent Literature	0178_bromine_and_its_compounds.pdf	3159815 0b46da9d237d1fe62b0a76c6f5c1b118029a8ea9	no	4
Warnings:					
Information:					

58	Non Patent Literature	0179_ca_oa_7_18_11.pdf	1193826 1b75d738fec89458d53d6ded907748698a90662f	no	3
Warnings:					
Information:					
59	Non Patent Literature	0180_ca_response_1_16_12.pdf	110559 36a7b8121b38e34720e9e53f1e35c3d0d5c1de17	no	5
Warnings:					
Information:					
		Total Files Size (in bytes):	44398274		

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.

Electronic Acknowledgement Receipt

EFS ID:	32660695
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	18-MAY-2018
Filing Date:	
Time Stamp:	11:23:36
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	0181_ca_office_action_03_03_09.pdf	1181540 b7437f680d75630d911c306062fb185e609b4a38	no	4

Warnings:

Information:					
2	Non Patent Literature	0182_4820001ca1_oarmisc_120709.pdf	122455 ec9a6e28d4224cde2ea3688a5fa22d2a57e14ec6	no	2
Warnings:					
Information:					
3	Non Patent Literature	0183_4820001ca1_aarmisc_031910.pdf	798246 9531036084bb6fc1f49169a9a2ff89cd86ddac2e	no	8
Warnings:					
Information:					
4	Non Patent Literature	0184_4820001ca1_aarmisc_090209.pdf	2012264 6605bc6990a645707432c8b69867d13a4de00dd0	no	21
Warnings:					
Information:					
5	Non Patent Literature	0185_3338002ca1.pdf	235440 52e5104c0bae76169e1697a0ff818795b9e2fcc3	no	2
Warnings:					
Information:					
6	Non Patent Literature	0186_4820007ca1_oarmisc_120715.pdf	298898 d3f3c91ff79377cf146b14769cc2a74ff9cd307b	no	3
Warnings:					
Information:					
7	Non Patent Literature	0187_4820007ca1_aarmisc_060616.pdf	1387087 4ef21b6253ce4ad19dfe19ebc86380ee5ebfd7b0	no	13
Warnings:					
Information:					
8	Non Patent Literature	0188_4820007ca1_vamd_013015.pdf	3118481 6b6b1f1c193b99d75e1a56e974e2c892cda8d155	no	27
Warnings:					
Information:					

9	Non Patent Literature	0189_ca_response_02_26_16.pdf	602552 a5cbc269a0e806ff0f8a58a5c67a7ca09950cb03	no	13
Warnings:					
Information:					
10	Non Patent Literature	0190_ca_office_action_04_02_15.pdf	1607961 b18632967fa18658e3115054e00afe9533144b32	no	5
Warnings:					
Information:					
11	Non Patent Literature	0191_4820006ca1_oarmisc_04242018.pdf	358499 ac02f210c0c75176bf94d31ebeb2cca75f23d46c	no	4
Warnings:					
Information:					
12	Non Patent Literature	0192_4820006ca1_oarmisc_083117.pdf	311026 70b03bc866b8f591654d1f66832dc1920391627a	no	4
Warnings:					
Information:					
13	Non Patent Literature	0193_ca_office_action_09_09_15.pdf	1142406 e91fb0e60ac1ac8c49c0aa8b2a3644e92c3925d3	no	3
Warnings:					
Information:					
14	Non Patent Literature	0194_3338016ca1_oarmisc_122216.pdf	1805776 62368df158899996c4a6ef25248e244dff58c052	no	5
Warnings:					
Information:					
15	Non Patent Literature	0195_2871422aarmisc_022718_20180226.pdf	493486 b0647f180cea18d4a13195935367f196a1a2d594	no	53
Warnings:					
Information:					

16	Non Patent Literature	0196_2871422aarmisc20170621_response_as_filed_00406200 4220170621.pdf	2186741 5c832bf47eda3c6eb923ac33da0ebdc0b4933b04	no	41
Warnings:					
Information:					
17	Non Patent Literature	0197_ca_response_08_28_15.pdf	1353363 1d06f732a3e9c71d184da6dcce22e643cc37d8cd	no	22
Warnings:					
Information:					
18	Non Patent Literature	0198_cn_notice_12_8_11.pdf	591064 b4ede0441854a283c0c7aa44e399fa85c6d5c36c	no	6
Warnings:					
Information:					
19	Non Patent Literature	0199_cn_response_1_20_12.pdf	163511 8ae78873a7e76e042cc09aaa4acf93ba4b675545	no	10
Warnings:					
Information:					
20	Non Patent Literature	0200_200580037037.pdf	6344738 eb2908573fce8fed7f6cc136fd06cf3d7d285b00	no	46
Warnings:					
Information:					
21	Non Patent Literature	0201_cn_officez_action_09_21_15.pdf	1418199 ab74bf1356648e910db84d7f888ae50bb7c59153	no	6
Warnings:					
Information:					
22	Non Patent Literature	0202_3338016cn1_aarmisc_011416.pdf	272302 2fdfaae42216ac11bf315a0d97b8430623662762	no	7
Warnings:					
Information:					

23	Non Patent Literature	0203_4820003cn1_oarmisc_011618.pdf	574589 5594a5f44ed2fbb0759a09e44377f5d9f80c3534	no	8
Warnings:					
Information:					
24	Non Patent Literature	0204_4820003cn1_oarmisc_071217.pdf	577833 c73b0256feb9c9e0696a9b3b8c702f03f3d94896	no	8
Warnings:					
Information:					
25	Non Patent Literature	0205_3338021cn1_oarmisc_072516.pdf	228376 4ed4106ade70d20aedddb9ef9d7f41bad6cadb54	no	4
Warnings:					
Information:					
26	Non Patent Literature	0206_3338021cn1_oarmisc_122316.pdf	3071494 81d6650433038e8622a079ea1f157758ecc0b6eb	no	39
Warnings:					
Information:					
27	Non Patent Literature	0207_pages_from_20148002570 19aarmiscsolidated_correspondence_041217_137201704112.pdf	1672011 7c1a4e2ecc242fe7d34cebcaeb5f2a1b27886c13	no	24
Warnings:					
Information:					
28	Non Patent Literature	0208_4820003cn1aarn20180327.pdf	1384511 d23246ecf55c7262f47d1247af1367b1e9f348a1	no	20
Warnings:					
Information:					
29	Non Patent Literature	0209_20148002570 19aarmisc_092017_20170915.pdf	1388120 ea1dd69760c11ff65f5a8a2d688c8d284a8c73dd	no	21
Warnings:					
Information:					

30	Non Patent Literature	0210_norit_darco_fgd_product_sheet.pdf	6899 c1bdda7420eb40469476f9ae6368d7ce626e5b8a	no	2
Warnings:					
Information:					
31	Non Patent Literature	0211_jp_49_53593.pdf	1452762 2533ca2299091786974659702 24b14f52ade9a06	no	4
Warnings:					
Information:					
32	Non Patent Literature	0212_ep_reply_09_09_11.pdf	4824185 dde5a39aae3b8e35aaede82e8f2cba8345a4ae94	no	20
Warnings:					
Information:					
33	Non Patent Literature	0213_4820001ep1_e2001_110509.pdf	365410 968d1b49815d6c19351063c361eace0b3e545e1f	no	4
Warnings:					
Information:					
34	Non Patent Literature	0214_4820001ep1_decisiontograrant_060812.pdf	241642 9c747adf012193de42561d6d02b0453541b75fe1	no	2
Warnings:					
Information:					
35	Non Patent Literature	0215_4820001ep1_eesr_041409.pdf	1295552 e92e0df4ccf157bf7f1da635dad8bdb3019fe623	no	13
Warnings:					
Information:					
36	Non Patent Literature	0216_ep_oa_01_25_08.pdf	334284 f66216f9227f5b01831c8d1a1307b8aafb219c21	no	2
Warnings:					
Information:					

37	Non Patent Literature	0217_4820001ep1_e2001_013112.pdf	340210 32a3e161bfdc2450ec249c0319efcafe605f723e	no	4
Warnings:					
Information:					
38	Non Patent Literature	0218_4820001ep1_oarmisc_042712.pdf	599692 2202a13dd7ddc0a37d02187591ac32f562a29ef9	no	6
Warnings:					
Information:					
39	Non Patent Literature	0219_ep_oa_11_05_09.pdf	995176 468f7263d0c84bfc48018a23b4a9feee52f1a8a7	no	4
Warnings:					
Information:					
40	Non Patent Literature	0220_ep_search_report_04_14_09.pdf	3337663 25ed11ad6e8651ef12214a2358b81c1c841e8982	no	13
Warnings:					
Information:					
41	Non Patent Literature	0221_4820001ep1_e2001ar_022812.pdf	4591101 1ab23c97ffd771a53aaf099005cc489b2347b64b	no	30
Warnings:					
Information:					
42	Non Patent Literature	0222_ep_response_04_18_08.pdf	2807308 da5e2004a2d4ce38e9f3da471e0330da4345bd4e	no	7
Warnings:					
Information:					
43	Non Patent Literature	0223_4820001ep1_e2001ar_051110.pdf	596365 46c357c2d51fe5c12b0c02f7b43788b27ddfc5d6	no	11
Warnings:					
Information:					

44	Non Patent Literature	0224_ep_response_05_11_10.pdf	596444 62f554ff6652d5d98867c6e29340a5cab36b214b	no	11
Warnings:					
Information:					
45	Non Patent Literature	0225_4820001ep1_eesrr_090911.pdf	2247234 4d0f49f6e9eb9879784d8e2174699452dba5402b	no	20
Warnings:					
Information:					
46	Non Patent Literature	0226_third_party_observations.pdf	674448 413e532b49835194f562547601af8d6cdd01ef8a	no	7
Warnings:					
Information:					
47	Non Patent Literature	0227_third_party_comment_12_04_07.pdf	1423804 868ee8c4089dbaf8f3b3ebfa6b24f922da14f7b0	no	5
Warnings:					
Information:					
48	Non Patent Literature	0228_4820007ep1_decisiontograntt_041714.pdf	239263 08850479170ac0cdf5f6f33190bf4d0106f81beb	no	2
Warnings:					
Information:					
49	Non Patent Literature	0229_4820007ep1_eesr_120612.pdf	509960 4653ab5bc6c998744383286a77ce8dcfe5b68675	no	5
Warnings:					
Information:					
50	Non Patent Literature	0230_4820007ep1_e2000c_031714.pdf	7019807 1eaeebad8903d34f6d571915da898bdb18568fb8	no	44
Warnings:					
Information:					

51	Non Patent Literature	0231_4820007ep1_e2000c_093013.pdf	6729745 eda4a87ba101d2c4528b9a2575279ce352ceae21	no	44
Warnings:					
Information:					
52	Non Patent Literature	0232_4820007ep1_aarmisc_020314.pdf	1209441 b33a315eaed3418e17a75812a4958e69468276a1	no	11
Warnings:					
Information:					
53	Non Patent Literature	0233_4820007ep1_eesrr_062013.pdf	2165807 94805c0afeec182d459da3cdb3a93807b9125788	no	18
Warnings:					
Information:					
54	Non Patent Literature	0234_3_4820001ep3_e2001_112612.pdf	325585 00325f93cefaac2c6087ac81ffc8d14471449802	no	4
Warnings:					
Information:					
55	Non Patent Literature	0235_7_4820001ep3_decision_121913.pdf	1394780 12ba2e3283820a769766dbe5fae33da10639f48e	no	18
Warnings:					
Information:					
56	Non Patent Literature	0236_1_4820001ep3_eesr_020112.pdf	741351 58a69ef5eac3c2d586ba0010a32f237d9bccb3a9	no	7
Warnings:					
Information:					
57	Non Patent Literature	0237_6_4820001ep3_oar_misc_110413.pdf	260204 f489372ac89db84875f35aa035ffd1d4641c9a4d	no	4
Warnings:					
Information:					

58	Non Patent Literature	0238_4_4820001ep3_e2001r4_020413.pdf	926255 8eaf0dd76f61c2eada89fdfcc712e7c8e4c5e0fa	no	9
Warnings:					
Information:					
59	Non Patent Literature	0239_2_4820001ep3_eesrr_082812.pdf	1062652 a49de21950dfd927fcb2a0568cbe17fcf3fb66af	no	9
Warnings:					
Information:					
60	Non Patent Literature	0240_5_4820001ep3_oarmisc_041513.pdf	632123 9605b8f85158cd4665f88c4cbe005cea96eedd5b	no	7
Warnings:					
Information:					
		Total Files Size (in bytes):	86650121		

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.

Electronic Acknowledgement Receipt

EFS ID:	32660992
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	18-MAY-2018
Filing Date:	
Time Stamp:	11:39:20
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	0241_4820001ep2_e2001_010913.pdf	351104 e109e2649f5744ec5d07dc53660d14370e0478da	no	4

Warnings:

Information:					
2	Non Patent Literature	0242_4820001ep2_decisiontogrant_050214.pdf	240462 ca001cd6a99dc548512718d43e364e519e15dec9	no	2
Warnings:					
Information:					
3	Non Patent Literature	0243_4820001ep2_eesr_012312.pdf	571430 fc0c918ef9e9c73b32f72dc743192de1925b8bb0	no	6
Warnings:					
Information:					
4	Non Patent Literature	0244_4820001ep2_eesr_050912.pdf	1199392 c690d4c5a204b22b9ef681a169bed4e23ff300c8	no	12
Warnings:					
Information:					
5	Non Patent Literature	0245_4820001ep2_e2001_103013.pdf	250910 5d0f52ea171967fc6817addee934b82fe8288f36	no	4
Warnings:					
Information:					
6	Non Patent Literature	0246_4820001ep2_oarmisc_121113.pdf	609177 1288110f536061efe47709dec279aaef9361fb05	no	6
Warnings:					
Information:					
7	Non Patent Literature	0247_4820001ep2_e2001ar_021113.pdf	706114 6a20a91989e1f14222d25831a0c530a53f463946	no	5
Warnings:					
Information:					
8	Non Patent Literature	0248_4820001ep2_aarmisc_101013.pdf	2039049 8ea23bbf03395ceccc08631da6f627aa1fe497a2	no	18
Warnings:					
Information:					

9	Non Patent Literature	0249_4820001ep2_eesrr_112212.pdf	1553518 7771ff4e5221c91fdcf9b4b6412943f582322ee8	no	13
Warnings:					
Information:					
10	Non Patent Literature	0250_4820001ep2_oarmisc_041513.pdf	598629 f7e5edf884d45ded895dbfa4f7f655a6da60ccc7	no	6
Warnings:					
Information:					
11	Non Patent Literature	0251_4820006ep1_oarmisc_042417.pdf	655145 3a6c3f1ea965aaeeab5e68a04d74c77648671b08	no	8
Warnings:					
Information:					
12	Non Patent Literature	0252_3338016ep1_oarmisc_051217.pdf	702326 c93169acb9ebda388cb896dbddf556774c2664f2	no	6
Warnings:					
Information:					
13	Non Patent Literature	0253_ep_oa_12_19_2014.pdf	338894 ab09c64510744edeba1369afbaed709221a5daeb	no	2
Warnings:					
Information:					
14	Non Patent Literature	0254_ep_response_06_29_2015.pdf	5327093 fd19a8091ba05a6da5b63866d26610e113d5711e	no	19
Warnings:					
Information:					
15	Non Patent Literature	0299_49_2_philadelphia_1004_1107.pdf	134171 b79629f175c14ea3d37bd0b35b7e4c5a9dede3a8	no	2
Warnings:					
Information:					

16	Non Patent Literature	0300_mochida_etal_1995.pdf	1917238 5383a1058ca9861b3a5268369e09b78cb1119051	no	9
Warnings:					
Information:					
17	Non Patent Literature	0301_nguyen_thanh_etal_2006.pdf	124058 f1bae781d6e0e6a6f8b1f72633a20d495dd009fb	no	2
Warnings:					
Information:					
18	Non Patent Literature	0302_nguyen_thanh_bandosz_2006.pdf	1275231 34e6e3451808c52fdf148cc766e6df19a2856a63	no	9
Warnings:					
Information:					
19	Non Patent Literature	0303_141953604.pdf	3074145 366a30fdbbb07cf618cf2a0cfc0fee4a67a74d60	no	36
Warnings:					
Information:					
20	Non Patent Literature	0304_3338013us1_olson_reduction_111808.pdf	2211794 8a88d84579a923c5a23e4fdc31cbf561a3f01e69	no	13
Warnings:					
Information:					
21	Non Patent Literature	0305_olson_2000.pdf	10902878 c2804152c09e6b303780310bf9425be658906da7	no	13
Warnings:					
Information:					
22	Non Patent Literature	0306_olson_etal_2005.pdf	4184423 567968480b167274f7074b13c6894e7c8e5c8440	no	8
Warnings:					
Information:					

23	Non Patent Literature	0307_154491121.pdf	171704 46fe236711a518046532df97263bdd351764ceb0	no	1
Warnings:					
Information:					
24	Non Patent Literature	0308_15449112.pdf	144498 9141f4a29424d12215c95a8a41f58ca2d181b033	no	1
Warnings:					
Information:					
25	Non Patent Literature	0309_141953603.pdf	1170245 884e3bbdefab113c1f20a1063093ec44c9759ceb	no	7
Warnings:					
Information:					
26	Non Patent Literature	0310_14195360_structural_characterization_of__n_taining.pdf	1883415 f4a2ba047bae73fa175616197b8cf34da0f8d2e6	no	12
Warnings:					
Information:					
27	Non Patent Literature	0311_alternatives_to_activated_carbon_for_mercury_trol__power_engineering.pdf	2220399 d8bc3b14cd52cac30345fc07cff2c02fea393f14	no	10
Warnings:					
Information:					
28	Non Patent Literature	0312_3338013us1_streng_toxics_111808.pdf	3793203 0ef023fe553d7def6762dfc4a20d89ded16c6fd3	no	14
Warnings:					
Information:					
29	Non Patent Literature	0313_3338013us1_tsuji_coke_process_111808.pdf	4198246 9939e1d2c4b806ac2bdef249ef44d7489d720331	no	27
Warnings:					
Information:					

30	Non Patent Literature	0314_vorsteen_2003.pdf	11088320 c27f32c6f101f201164529b277f37ff3d2024e6c	no	31
Warnings:					
Information:					
31	Non Patent Literature	0315_seminar_ep_application.pdf	1123207 6c601ea64aa363be51eca55aea4efee56b88404e	no	6
Warnings:					
Information:					
32	Non Patent Literature	0316_vorsteen_2006.pdf	1306443 7e0a572bcd2d24d026038f3d08813370bffa8424	no	6
Warnings:					
Information:					
33	Non Patent Literature	0317_vorsteen2003.pdf	6768944 25fb9049a0043be4fbd947fe059ef39b47059cef	no	24
Warnings:					
Information:					
34	Non Patent Literature	0318_qi_2010.pdf	6661541 9c92fb0a33611d7b111f6036c6956b41be665ac9	no	6
Warnings:					
Information:					
35	Non Patent Literature	0319_wang_smith.pdf	949883 8551bd5f7fddc17f1f1917f334d9907e4c7b3757	no	8
Warnings:					
Information:					
36	Non Patent Literature	0320_zhang_2009.pdf	6581719 474c7735ac346c9d36a308d16afd4ceaaf6db8a8	no	6
Warnings:					
Information:					

37	Non Patent Literature	0321_zhao_2006.pdf	3949191 4c0e3fd9c7e39c6049fa08aca76958732e907dfc	no	8
Warnings:					
Information:					
38	Non Patent Literature	0322_zheng_2012.pdf	22977543 73d2b873a9e5e06d43e7c0d589ff30ea6afd4d3d	no	31
Warnings:					
Information:					
39	Non Patent Literature	0323_zhu_enhanced.pdf	927790 4bf13e594cd7f4a34ad4c827d34c2307b8e59226	no	7
Warnings:					
Information:					
40	Non Patent Literature	0324_3338016us2_pamd_121014.pdf	421831 f5ee72c5e7668b62b28ce49215c8ad655a2f5dd3	no	6
Warnings:					
Information:					
41	Non Patent Literature	0325_jp4953594.pdf	242099 f232c8042a71bfcfe2645a2f668aab7705c6547f	no	1
Warnings:					
Information:					
42	Non Patent Literature	0326_olson_2001.pdf	2329136 632bc9ede48e9ed770b6b9bf35b6620e950b6945	no	19
Warnings:					
Information:					
		Total Files Size (in bytes):	117876538		

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.

Electronic Acknowledgement Receipt

EFS ID:	32661069
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	18-MAY-2018
Filing Date:	
Time Stamp:	11:43:36
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	Foreign Reference	0021_de3816600a1.pdf	1520038 08c4e9768f01af753b356b43a8e42b521d817000	no	13

Warnings:

Information:					
2	Foreign Reference	0022_ep0208490a1.pdf	1758358 3f8c4eb52efb57b59b92e7bdd3cde13debff5a2c	no	14
Warnings:					
Information:					
3	Foreign Reference	0023_ep1386655a1.pdf	2891154 aa638e851784a95fc0e438b2cae63b943306f1a5	no	23
Warnings:					
Information:					
4	Foreign Reference	0024_ep1458474a1__espacenet_description.pdf	76338 8e4e99f085433d4596dd7ef1eeea55b69994b5c1	no	22
Warnings:					
Information:					
5	Foreign Reference	0025_ep_1570894a1.pdf	4536322 28aeee986df48f9a57ab20ac8d489451a6656ed2	no	14
Warnings:					
Information:					
6	Non Patent Literature	0055_10554018_noar_011912.pdf	915937 329e79647885d5200b6bebeaa1171276f79de3fe	no	7
Warnings:					
Information:					
7	Non Patent Literature	0056_3338013us1_aarn_020810.pdf	705845 be6d4b3f2ab04d8e0d89a6a9959ed5d91e6b4ef0	no	9
Warnings:					
Information:					
8	Non Patent Literature	0057_3338013us1_rerr_r_081009.pdf	81919 c4d0918ff67e728bd6156fd3cc4d6c7eba55b3a3	no	1
Warnings:					
Information:					

9	Non Patent Literature	0058_3338013us1_rerr_060909.pdf	417946 80f1167daea4aef4c0b02fc1a2b9f607712cdbde	no	5
Warnings:					
Information:					
10	Non Patent Literature	0059_advisory_action_04_21_08.pdf	835791 88f145a5861d17d53822e0aff0eff6f3a7bf1158	no	3
Warnings:					
Information:					
11	Non Patent Literature	0060_final_oa_01_23_2008.pdf	5840947 d5093d25268d5e716d6c6fefccc2a3388197aa27	no	20
Warnings:					
Information:					
12	Non Patent Literature	0061_non_final_oa_08_13_07.pdf	4408721 66ece423b3ce61788a176ef43dc0488b4105dcdc	no	14
Warnings:					
Information:					
13	Non Patent Literature	0062_3338005us1_noar_101408.pdf	808891 957d0c1aba1bdd81b4013eeee8ba32c9e359222b	no	7
Warnings:					
Information:					
14	Non Patent Literature	0063_prel_azmend_02_27_07.pdf	1998859 d69683cce97b26efe040c6e7630e600e9aeaea07	no	9
Warnings:					
Information:					
15	Non Patent Literature	0064_response_03_24_08.pdf	10172094 760e605d973e91322c005e24a854cdd72837030b	no	29
Warnings:					
Information:					

16	Non Patent Literature	0065_3338005us1_rrr_070907.pdf	120258 9d42f953d79e3ed0b59cf62d24ab00d6ab491789	no	2
Warnings:					
Information:					
17	Non Patent Literature	0066_3338005us1_aarn_111307.pdf	2255877 944f599810aa5d71e099f6904bffc74e78da18eb	no	19
Warnings:					
Information:					
18	Non Patent Literature	0067_3338005us1_rerr_060707.pdf	622880 863642dab189fb3b955f3ac4da36ac6437120538	no	6
Warnings:					
Information:					
19	Non Patent Literature	0068_3338002us1exir4511.pdf	386116 3eefdbfb75553475460c0a5f79f30c3a072ca17e	no	3
Warnings:					
Information:					
20	Non Patent Literature	0069_3338002us1_foar_051111.pdf	1752774 d7f563380b32dc8f53d2145386b3f588caf8b5bd	no	15
Warnings:					
Information:					
		Total Files Size (in bytes):	42107065		

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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/978,760

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))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 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

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

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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
15/978,760	05/14/2018	1776	1720	4820.007US4	20	2

CONFIRMATION NO. 6432

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

FILING RECEIPT

OC000000100075045

Date Mailed: 06/07/2018

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 CIP of 15/295,594 10/17/2016
which is a CON of 14/102,896 12/11/2013 PAT 9468886
which is a CON of 12/429,058 04/23/2009 PAT 8652235
which is a CIP 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 15/978,760**

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

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.

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.
15/978,760	05/14/2018	Edwin S. Olson	4820.007US4	6432

21186 7590 06/13/2018

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MINNESOTA 55402
UNITED STATES OF AMERICA

EXAMINER
ORLANDO, AMBER ROSE

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
06/13/2018	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

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 15/978,760	**Applicant(s)** Olson et al.	
	Examiner JoAnne Burke	**Art Unit** OPET	**AIA (First Inventor to File) Status** No

1. THE REQUEST FILED 14 May 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 JoAnne Burke at (571)272-4584. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/JOANNE L BURKE/ Paralegal Specialist, OPET	

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.
15/978,760	05/14/2018	Edwin S. Olson	4820.007US4	6432

21186 7590 06/29/2018

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MINNESOTA 55402
UNITED STATES OF AMERICA

EXAMINER
ORLANDO, AMBER ROSE

ART UNIT	PAPER NUMBER
1776	

NOTIFICATION DATE	DELIVERY MODE
06/29/2018	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. 15/978,760	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 5/14/2018.

☐ 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) 2-21 is/are pending in the application.

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

6) ☑ Claim(s) 2-19 is/are allowed.

7) ☑ Claim(s) 20-21 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 5/14/2018 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

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(s) 20 are is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Nelson Jr. US 2004/00033716 in view of Vosteen et al. US 6,878,358.

For claim 20, the Nelson reference discloses a method for separating mercury from a mercury-containing gas, the method comprising: reacting mercury in a mercury-containing gas with an injected in-flight promoted activated carbon sorbent to form a mercury/sorbent composition, wherein the promoter comprises Br2, HBr, Br^-, or a combination thereof (paragraphs [0044], [0055] [0059] and [0060]); separating the mercury/sorbent composition from the mercury-containing gas (paragraph [0060]).

The Vosteen et al. 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 (column 5, lines 47-63).

It would have been obvious to one having ordinary skill in the art at the time 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 (Vosteen column 5, lines 47-63) to achieve a desired level of mercury removal. The Vosteen

reference clearly shows that complete removal of the mercury in the mercury-containing gas (i.e. greater than 70% closer to 100% is desired) and is desired and obtainable by adding more absorbent.

Claim(s) 21 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Nelson Jr. US 2004/00033716 and Vosteen et al. US 6,878,358 as applied in claim 20 and further in view of Comrie US 2007/0168213.

For claim 21, the Nelson reference discloses reacting the mercury in the mercury-containing gas with the promoted halogenated activated carbon sorbent to form the mercury/sorbent composition comprises reacting the mercury in the mercury-containing gas with the promoted halogenated activated carbon sorbent (as shown above)

The Comrie reference discloses reacting the mercury in the mercury-containing gas with a promoted halogenated non-carbon sorbent to form the mercury/sorbent composition (paragraph [0035]).

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 reacting the mercury in the mercury-containing gas with a promoted halogenated non-carbon sorbent to form the mercury/sorbent composition (Comrie paragraph [0035]) so as to further allow for the collection or removal of mercury and/or sulfur from coal burning.

Allowable Subject Matter

Claims 2-19 are allowed.

The following is an examiner's statement of reasons for allowance: for claim 2, the prior art does not disclose the mercury containing gas provided by the combusting coal in the combustion chamber including halogen or halide promoter and then subsequently injecting a sorbent material including activated carb into the mercury-containing gas, such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent.

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."

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 20 and 21 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 and 11 of U.S. Patent No. 8,652,235 ('235). Although the claims at issue are not identical, they are not patentably distinct from each other because:

Claim 20 of the current application corresponds to claim 1 of '235.

Claim 21 of the current application corresponds to claim 11 of '235.

Claims 20 is rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 of U.S. Patent No. 7,435,286 ('286). Although the claims at issue are not identical, they are not patentably distinct from each other because:

Claim 20 of the current application corresponds to claim 1 of '286.

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

Examiner-Initiated Interview Summary	**Application No.** 15/978,760	**Applicant(s)** Olson et al.		
	Examiner AMBER R ORLANDO	**Art Unit** 1776	**AIA (First Inventor to File) Status** No	**Page** **1 of** 1

All participants (applicant, applicants representative, PTO personnel):

1. AMBER R ORLANDO (Primary Examiner); Telephonic 2. Nicholas Lansatella (Attorney); Telephonic

Date of Interview: 14 June 2018

Claims Discussed: 2-21

Issues Discussed:

Item(s) under 35 U.S.C. 112:
The examiner asked for clarification where exactly the new claims 2-21 have support within the originally filed application. The applicant pointed to figure 6. The examiner agreed.

/AMBER R ORLANDO/ Primary Examiner, Art Unit 1776	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/978,760	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
IDS Search (EAST and DAV)	06/24/2018	AO
Inventor Search (DAV)	06/24/2018	AO
EAST searched for inflight promotion of sorbents.	06/24/2018	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Bibliographic Data

Application No: 15/978,760

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.
05/14/2018	095	1776	4820.007US4
RULE			

APPLICANTS

Midwest Energy Emissions Corp, Lewis Center, OH,

INVENTORS

Edwin S. Olson Grand Forks, ND, UNITED STATES

Michael J. Holmes Thompson, ND, UNITED STATES

John H. Pavlish East Grand Forks, MN, UNITED STATES

CONTINUING DATA

This application is a CIP of 15295594 10/17/2016

15295594 is a CON of 14102896 12/11/2013 PAT 9468886

14102896 is a CON of 12429058 04/23/2009 PAT 8652235

12429058 is a CIP of 12201595 08/29/2008

12201595 is a DIV 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

UNITED STATES

ADDRESS

SCHWEGMAN LUNDBERG & WOESSNER, P.A.

P.O. BOX 2938

MINNEAPOLIS, MN 55402

UNITED STATES

FILING FEE RECEIVED

$5,860

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 1 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-1,984,164	12/11/1934	Alfred, Stock
	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.
	US-20020134242A1	9/26/2002	Yang, Ralph T, et al.
	US-20020150516A1	10/17/2002	Pahlman, John, et al.
	US-20030057293A1	3/27/2003	Boecking, Friedrich
	US-20030104937A1	6/5/2003	Sinha, R. K.
	US-20030136509A1	7/24/2003	Virtanen, Jorma
	US-20030206843A1	11/6/2003	Sidney Jr, Nelson G
	US-20030206846A1	11/6/2003	Jangbarwala, Juzer
	US-20040003716A1	1/8/2004	Nelson Jr, Sidney
	US-20040013589A1	1/22/2004	Vosteen, Bernhard, et al.
	US-20040076570A1	4/22/2004	Jia, Charles Q
	US-20040109800	6/10/2004	Pahlman, John E, et al.
	US-20050000197A1	1/6/2005	Krantz, Jeffrey
	US-20050019240A1	1/27/2005	Lu, Xiao-chun, et al.
	US-20050074380A1	4/7/2005	Boren, Richard M, et al.
	US-20050147549A1	7/7/2005	Lissianski, Vitali Victor, et al.
	US-20050227146A1	10/13/2005	Ghantous, Dania, et al.
	US-20060048646A1	3/9/2006	Olson, Edwin S, et al.
	US-20060057044A1	3/16/2006	Chang, Shih-ger, et al.
	US-20060112823A1	6/1/2006	Avina, David Christopher
	US-20060191835A1	8/31/2006	Petrik, Viktor I, et al.
	US-20060204418A1	9/14/2006	Chao, Chien-chung, et al.
	US-20070167309A1	7/19/2007	Olson, Edwin S.
	US-20070168213A1	7/19/2007	Comrie, Douglas C
	US-20070234902A1	10/11/2007	Fair, David L, et al.
	US-20070295347A1	12/27/2007	Paine III, John B, et al.
	US-20080090951A1	4/17/2008	Mao, Dongsheng, et al.
	US-20080107579A1	5/8/2008	Downs, William, et al.
	US-20080134888A1	6/12/2008	Chao, Chien-chung, et al.
	US-20080182747A1	7/31/2008	Sinha, R. K.
	US-20080207443A1	8/28/2008	Gadkaree, Kishor Purushottam, et al.
	US-20080292512A1	11/27/2008	Kang, Shin G.

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 2 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20090031708A1	2/5/2009	Schmidt, Darren D.
	US-20090062119A1	3/5/2009	Olson, Edwin S., et al.
	US-20090081092A1	3/26/2009	Yang, Xiaolin David, et al.
	US-20090136401A1	5/28/2009	Yang, Xiaolin David, et al.
	US-20090235848A1	9/24/2009	Eiteneer, Boris Nikolaevich, et al.
	US-20090320678A1	12/31/2009	Chang, Ramsay, et al.
	US-20100024642A1	2/4/2010	Fukumoto, Kazuhiro, et al.
	US-20100047146A1	2/25/2010	Olson, Edwin S., et al.
	US-20110076210A1	3/31/2011	Pollack, Nicholas R, et al.
	US-20110168018A1	7/14/2011	Mohamadalizadeh, Ali, et al.
	US-20120183458A1	7/19/2012	Olson, Edwin S, et al.
	US-20130280156A1	10/24/2013	Olson, Edwin S, et al.
	US-2014/0224121A1	8/14/2014	Mimna, Richard A., et al.
	US-20140056787A1	2/27/2014	Olson, Edwin S, et al.
	US-20140255279A1	9/11/2014	Olson, Edwin S, et al.
	US-20140308188A1	10/16/2014	Olson, Edwin S, et al.
	US-20150098878A1	4/9/2015	Olson, Edwin S
	US-20150246315A1	9/3/2015	Olson, Edwin S, et al.
	US-20170100692A1	4/13/2017	Olson, Edwin S, et al.
	US-20170128908A1	5/11/2017	Olson, Edwin S., et al.
	US-20170173524A1	6/22/2017	Olson, Edwin S, et al.
	US-20170173557A1	6/22/2017	Olson, Edwin S, et al.
	US-20170239644A1	8/24/2017	Olson, Edwin S, et al.
	US-2,317,857	4/27/1943	Soday, Frank J
	US-2,456,272A1	2/7/2002	Pahlman, John, et al.
	US-3,194,629	7/13/1965	Dreibelbis, John A, et al.
	US-3,341,185	9/12/1967	Kennedy, Sr, Walter L
	US-3,662,523	5/16/1972	Revoir, William H, et al.
	US-3,786,619	1/22/1974	Melkersson, Karl-axel
	US-3,826,618	7/30/1974	Capuano, Italo A
	US-3,849,267	11/19/1974	Hilgen, Hendrika, et al.
	US-3,876,393	4/8/1975	Kasai, Juichi, et al.
	US-3,935,708	2/3/1976	Harrewijne, A., et al.
	US-4,094,777	6/13/1978	Sugier, Andre, et al.
	US-4,101,631	7/18/1978	Ambrosini, Ronald Frank, et al.
	US-4,196,173	4/1/1980	DeJong, Geert J, et al.
	US-4,338,896	7/13/1982	Papasideris, Stamos I.

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 3 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-4,342,192	8/3/1982	Heyn, K., et al.
	US-4,500,327	2/19/1985	Nishino, Hirosh, et al.
	US-4,530,765	7/23/1985	Sabherwal, Inderjit H
	US-4,708,853	11/24/1987	Matviya, Thomas, et al.
	US-4,772,455	9/20/1988	Izumi, Kazuo, et al.
	US-4,786,483	11/22/1988	Audeh, Costandi A
	US-4,814,152	3/21/1989	Yan, Tsoung Y
	US-4,820,318	4/11/1989	Chang, Chin-hsiung, et al.
	US-4,889,698	12/26/1989	Moller, Jens, et al.
	US-4,956,162	9/11/1990	Smith, et al.
	US-4,956,162	9/11/1990	Smith, Wallace B, et al.
	US-5,245,120	9/14/1993	Srinivasachar, Srivats, et al.
	US-5,288,306	2/22/1994	Aibe, Toshio, et al.
	US-5,300,137	4/5/1994	Weyand, Thomas E., et al.
	US-5,336,835	8/9/1994	McNamara, James D.
	US-5,346,674	9/13/1994	Weinwurm, Peter, et al.
	US-5,409,522	4/25/1995	Durham, Michael D, et al.
	US-5,419,834	5/30/1995	Straten, Gunter
	US-5,435,980	7/25/1995	Felsvang, Karsten S, et al.
	US-5,462,908	10/31/1995	Liang, Septimus -C H, et al.
	US-5,480,619	1/2/1996	Johnson, Dennis, et al.
	US-5,500,306	3/19/1996	Hsu, M. S., et al.
	US-5,505,766	4/9/1996	Chang, Ramsay
	US-5,575,982	11/19/1996	Reiss, Guenter, et al.
	US-5,607,496	3/4/1997	Brooks, Richard J
	US-5,672,323	9/30/1997	Bhat, Pervaje, et al.
	US-5,695,726	12/9/1997	Lerner, B J.
	US-5,695,726	12/9/1997	Lerner, B.
	US-5,827,352	10/27/1998	Altman, Ralph, et al.
	US-5,891,324	4/6/1999	Ohtsuka, Kiyoto
	US-6,001,762	12/14/1999	Harmer, Mark Andrew, et al.
	US-6,013,593	1/11/2000	Lee, Hoo-kun, et al.
	US-6,027,551	2/22/2000	Hwang, Jiann-Yang, et al.
	US-6,074,974	6/13/2000	Lee, Jung-min, et al.
	US-6,080,281	6/27/2000	Attia, Yosry A
	US-6,136,072	10/24/2000	Sjostrom, Sharon, et al.
	US-6,136,749	10/24/2000	Gadkaree, Kishor P, et al.

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 4 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-6,214,304	4/10/2001	Rosenthal, Jurgen, et al.
	US-6,258,334	7/10/2001	Gadkaree, Kishor, et al.
	US-6,342,462	1/29/2002	Kulprathipanja, Santi
	US-6,372,187	4/16/2002	Madden, Deborah A, et al.
	US-6,375,909	4/23/2002	Dangtran, Ky, et al.
	US-6,383,981	5/7/2002	Blankenship, Steven, et al.
	US-6,471,936	10/29/2002	Chen, Pin, et al.
	US-6,475,451	11/5/2002	Leppin, Dennis, et al.
	US-6,528,030	3/4/2003	Madden, Deborah A., et al.
	US-6,576,585	6/10/2003	Fischer, Stefan, et al.
	US-6,579,507	6/17/2003	Pahlman, John, et al.
	US-6,596,661	7/22/2003	Neufert, Ronald
	US-6,610,263	8/26/2003	Pahlman, John, et al.
	US-6,638,485	10/28/2003	Iida, Kozo, et al.
	US-6,808,692	10/26/2004	Oehr, Klaus H.
	US-6,818,043	11/16/2004	Chang, Ramsay, et al.
	US-6,848,374	2/1/2005	Srinivasachar, Srivats, et al.
	US-6,878,358	4/12/2005	Vosteen, Bernhard, et al.
	US-6,942,840	9/13/2005	Broderick, Thomas E
	US-6,953,494	10/11/2005	Nelson Jr., Sidney, et al.
	US-6,960,329	11/1/2005	Sellakumar, Kumar M.
	US-7,017,330	3/28/2006	Bellows, James C.
	US-7,081,434	7/25/2006	Sinha, Rabindra K.
	US-7,124,591	10/24/2006	Baer, Joan Mae, et al.
	US-7,211,707	5/1/2007	Axtell, Holly C, et al.
	US-7,247,279	7/24/2007	Pahlman, John, et al.
	US-7,293,414	11/13/2007	Huber, David J.
	US-7,435,286	10/14/2008	Olson, Edwin S, et al.
	US-7,435,286	10/14/2008	Olson, Edwin S., et al.
	US-7,442,239	10/28/2008	Armstrong, J. A., et al.
	US-7,479,263	1/20/2009	Chang, Shih-ger, et al.
	US-7,514,052	4/7/2009	Lissianski, Vitali Victor, et al.
	US-7,521,032	4/21/2009	Honjo, Shintaro, et al.
	US-7,544,338	6/9/2009	Honjo, S., et al.
	US-7,563,311	7/21/2009	Graham, James R
	US-7,611,564	11/3/2009	Mcchesney, Joe, et al.
	US-7,622,092	11/24/2009	Honjo, S., et al.

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 5 of 19	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-7,722,843	5/25/2010	Srinivasachar, S.
	US-7,767,174	8/3/2010	Lui, K., et al.
	US-7,780,765	8/24/2010	Srinivasachar S., et al.
	US-7,938,571	5/10/2011	Irvine, James H
	US-7,942,566	5/17/2011	Irvine, James H
	US-8,007,749	8/30/2011	Chang, Shih-ger, et al.
	US-8,080,088	12/20/2011	Srinivasachar, Srivats
	US-8,168,147	5/1/2012	Olson, Edwin S, et al.
	US-8,168,149	5/1/2012	Gal, Eli, et al.
	US-8,173,566	5/8/2012	Olson, Edwin S, et al.
	US-8,216,535	7/10/2012	Pollack, Nicholas R, et al.
	US-8,512,655	8/20/2013	Olson, Edwin S, et al.
	US-8,652,235	2/18/2014	Olson, Edwin S, et al.
	US-8,821,819	9/2/2013	Olson, Edwin S, et al.
	US-9,011,805	4/21/2015	Olson, Edwin S, et al.
	US-9,468,886	10/18/2016	Olson, Edwin S, et al.
	US-9,662,629	5/30/2017	Olson, Edwin S, et al.
	US-9,669,355	6/6/2017	Olson, Edwin S, et al.
	US-9,757,689	9/12/2017	Olson, Edwin S, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	CA-1099490A	4/21/1981	DeJong, Geert, et al.	
	CA-2150529A1	12/29/1995	Scherer, Volker, et al.	
	CA-2327602A1	6/6/2001	Robles, Antonio	
	CA-2400898A1	8/30/2001	Maes, Rudy J, et al.	
	CA-2584327A1	4/13/2006	Pavlish, John H, et al.	
	CA-2757309A1	10/28/2010	Olson, Edwin S, et al.	
	CA-2757309C	1/3/2017	Olson, Edwin S, et al.	
	CN-101048218A	10/3/2007	Olson, Edwin S, et al.	
	CN-101053820A	10/17/2007	Geng, Jianming Qian	
	CN-101293196A	10/29/2008	Zhenglong, Yang	
	CN-101816922A	9/1/2010	Song, Hu, et al.	
	CN-102413899A	4/11/2012	Olson, Edwin S, et al.	
	CN-104519410A	4/15/2015	Olson, Edwin S., et al.	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 6 of 19	Attorney Docket No: 4820.007US4	

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	CN-104619410B	5/4/2016	Olson, Edwin S, et al.	
	CN-1048173A	1/2/1991	Guoguan, et al.	
	CN-105188910A	12/23/2015	Olson, Edwin S.	
	CN-107661744A	2/6/2018	Olson, Edwin S, et al.	
	DE-10233173A1	2/12/2004	Vosteen, Bernhard, et al.	
	DE-202012003747U1	11/15/2012		
	DE-3426059A1	1/16/1986	Seipenbusch, Jurgen, et al.	
	DE-3816600A1	11/23/1989	Kaizik, Alfred, Dr., et al.	
	EP-0208490A1	1/14/1987	Moller, Jens Thousig, et al.	
	EP-1386655A1	2/4/2004	Vosteen, Vosteen Bernhard, et al.	
	EP-1458474	9/22/2004	Hammel, Charles F, et al.	
	EP-1570894A1	9/7/2005	Lissianski, V. V.	
	FR-2529802	1/13/1984	Pelosi, J., et al.	
	GB-2122916A	1/25/1984	Nishino, Hiroshi, et al.	
	JP-09256812	9/30/1997	Masanori, K., et al.	
	JP-4943197B4	11/19/1974	Yokota, Noriyuki, et al.	
	JP-4953590A	5/24/1974		
	JP-4953593A	5/24/1974		
	JP-4966592A	6/27/1974		
	JP-50145324A	3/3/1980		
	JP-506438B4	3/13/1975	Yokota, Noriyuki, et al.	
	JP-51003386A	1/12/1976	Soya, Kensuke, et al.	
	JP-544868A	1/13/1979	Seki, Michiharu, et al.	
	KR-1020027006149	7/2/2002	Tsuyoshi, O., et al.	
	SU-1163982A	6/30/1985	Belozerov, I. M.	
	SU-732207A1	5/5/1980	Valueva, Svetlana P, et al.	
	WO-0162368A1	8/30/2001	Maes, Rudy J, et al.	
	WO-0228513A2	4/11/2002	Pahlman, John E, et al.	
	WO-03072241A1	9/4/2003	Hammel, Charles F, et al.	
	WO-2004089501A2	10/21/2004	Mazyck, D. W., et al.	
	WO-2004094024A2	11/4/2004	Olson, Edwin, et al.	
	WO-2006039007A2	4/13/2006	Olson, Edwin S, et al.	
	WO-2006039007A3	4/13/2006	Olson, Edwin S, et al.	
	WO-2006099611A1	9/21/2006	Comrie, Douglas C, et al.	
	WO-2009018539A3	2/5/2009	Schmidt, Darren D.	
	WO-2010123609A1	10/28/2010	Olson, Edwin S, et al.	
	WO-2013162968A2	10/31/2013	Olson, Edwin S, et al.	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 7 of 19	Attorney Docket No: 4820.007US4	

FOREIGN PATENT DOCUMENTS				
Examiner Initial *	**Foreign Document Number**	**Publication Date**	**Name of Patentee or Applicant of cited Document**	**T1**
	WO-2013162968A3	10/31/2013	Olson, Edwin, et al.	
	WO-2014137907A2	9/12/2014	Olson, Edwin S, 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. 10/554,018 Response filed 11-01-10 to Final Office Action mailed 04-27-10", 17 pgs	
	"Application Serial No. 10/554,018, Final Office Action mailed 04-27-10", 8 pgs	
	"Application Serial No. 10/554,018, Non Final Office Action mailed 10-06-09", 8 pgs	
	"Application Serial No. 10/554,018, Notice of Allowance mailed 01-19-12", 7 pgs	
	"Application Serial No. 10/554,018, Response filed 02-08-10 to Non Final Office Action mailed 10-06-09", 9 pgs	
	"Application Serial No. 10/554,018, Response filed 08-10-09 to Restriction Requirement mailed 06-09-09", 1 pg	
	"Application Serial No. 10/554,018, Restriction Requirement mailed 06-09-09", 5 pgs	
	"Application Serial No. 11/209,163, Advisory Action mailed 04-21-08", 3 pgs.	
	"Application Serial No. 11/209,163, Final Office Action mailed 01-23-08", 20 pgs	
	"Application Serial No. 11/209,163, Non Final Office Action mailed 08-13-07", 14 pgs.	
	"Application Serial No. 11/209,163, Notice of Allowance mailed 07-14-08", 7 pgs	
	"Application Serial No. 11/209,163, Preliminary Amendment filed 02-27-07", 9 pgs	
	"Application Serial No. 11/209,163, Response filed 03-24-08 to Final Office Action mailed 01-23-08", 29 pgs	
	"Application Serial No. 11/209,163, Response filed 07-09-07 to Restriction Requirement mailed 06-07-07", 2 pgs	
	"Application Serial No. 11/209,163, Response filed 11-13-07 to Non Final Office Action mailed 08-13-07", 19 pgs	
	"Application Serial No. 11/209,163, Restriction Requirement mailed 06-07-07", 6 pgs	
	"Application Serial No. 12/184,860, Examiner Interview Summary mailed 04-05-11", 3 pgs	
	"Application Serial No. 12/184,860, Final Office Action mailed 05-11-11", 15 pgs	
	"Application Serial No. 12/184,860, Non Final Office Action mailed 01-19-11", 14 pgs	
	"Application Serial No. 12/184,860, Response filed 04-07-11 to Non Final Office Action mailed 01-19-11", 12 pgs	
	"Application Serial No. 12/184,860, Response filed 07-08-11 to Final Office Action mailed 05-11-11", 11 pgs	
	"Application Serial No. 12/201,595, Final Office Action mailed 03-10-10", 13 pgs.	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 8 of 19	Attorney Docket No: 4820.007US4	

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.	
	"Application Serial No. 13/427,665, Non Final Office Action mailed 08-03-12", 12 pgs.	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 9 of 19	Attorney Docket No: 4820.007US4	

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. 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	
	"Application Serial No. 13/427,665, Response filed 10-10-12 to Non Final Office Action mailed 08-03-12", 15 pgs	
	"Application Serial No. 13/427,685, Preliminary Amendment filed 03-22-12", 3 pgs	
	"Application Serial No. 13/453,274, Advisory Action mailed 11-24-14", 3 pgs	
	"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.	
	"Application Serial No. 13/966,768, Response filed 03-06-14 to Non Final Office Action mailed 12-06-13", 6 pgs.	
	"Application Serial No. 13/966,768, Supplemental Preliminary Amendment filed 08-15-13", 6 pgs.	
	"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	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 10 of 19	Attorney Docket No: 4820.007US4	

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. 14/195,360, Non Final Office Action mailed 06-20-16", 11 pgs	
	"Application Serial No. 14/195,360, Non Final Office Action mailed 06-20-16", 11 pgs	
	"Application Serial No. 14/195,360, Non Final Office Action mailed 11-24-15", 19 pgs	
	"Application Serial No. 14/195,360, Notice of Allowance mailed 02-07-17", 5 pgs	
	"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	
	"Application Serial No. 14/712,558, Non Final Office Action mailed 07-06-17", 7 pgs	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 11 of 19	Attorney Docket No: 4820.007US4	

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, Response filed 01-23-18 to Final Office Action mailed 12-06-17", 13 pgs	
	"Application Serial No. 14/712,558, Response filed 04-02-18 to Final Office Action mailed 12-06-17", 7 pgs.	
	"Application Serial No. 14/712,558, Response filed 10-06-17 to Non Final Office Action mailed 07-06-17", 12 pgs	
	"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.	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 02-21-18", 15 pgs	
	"Application Serial No. 15/589,359, Preliminary Amendment filed 01-03-18", 6 pgs	
	"Application Serial No. PCT/US04/12828, International Search Report mailed 10/22/2004", 2 pgs	
	"Application Serial No. PCT/US2014/019916, International Preliminary Report on Patentability mailed 09-17-15", 14 pgs	
	"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	
	"Canadian Application Serial No. 2,523,132, Office Action mailed 07-18-11", 3 pgs	
	"Canadian Application Serial No. 2,523,132, Response filed 01-16-12 to Office Action mailed 7-18-11", 5 pgs	
	"Canadian Application Serial No. 2,584,327, Office Action mailed 03-03-09", 4 pgs.	
	"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	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 12 of 19	Attorney Docket No: 4820.007US4	

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**
	"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	
	"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 04-24-18", 4 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	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 13 of 19	Attorney Docket No: 4820.007US4	

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
	"Chinese Application Serial No. 201480025701.9, Office Action mailed 12-23-16", 24 pgs.	
	"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.	
	"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	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 14 of 19	Attorney Docket No: 4820.007US4	

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
	"European Application Serial No. 10767465.7, Intention to Grant mailed 03-17-14", 44 pgs	
	"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	
	"European Application Serial No. 11189252.7, Office Action mailed 12-11-13", 6 pgs	
	"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	
	"European Application Serial No. 11189252.7, Response filed 10-10-13 to Office Action mailed 04-15-13", 18 pgs	
	"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	
	"European Application Serial No. 13719338.9, Office Action mailed 12-19-14", 2 pgs.	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 15 of 19	Attorney Docket No: 4820.007US4	

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
	"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	
	"European Application Serial No. 14711106.6, Response filed 08-17-17 to Communication Pursuant to Article 94(3) EPC mailed 02-22-17", 10 pgs	
	"International Application No. PCT/US2008/071986, International Search Report mailed 01-30-09", 3 pgs	
	"International Application Serial No. PCT/US2005/030018, International Preliminary Report on Patentability mailed 12-27-06", 3 pgs	
	"International Application Serial No. PCT/US2005/030018, International Search Report mailed 07-25-06", 2 pgs	
	"International Application Serial No. PCT/US2005/030018, Written Opinion mailed 07-25-06", 3 pgs	
	"International Application Serial No. PCT/US2010/022807, International Preliminary Report on Patentability mailed 11-03-11", 6 pgs	
	"International Application Serial No. PCT/US2010/022807, International Search Report mailed 09-13-10", 3 pgs	
	"International Application Serial No. PCT/US2010/022807, Written Opinion mailed 09-13-10", 4 pgs	
	"International Application Serial No. PCT/US2013/036964, International Preliminary Report on Patentability mailed 07-17-14", 11 pgs	
	"International Application Serial No. PCT/US2013/036964, International Search Report mailed 11-29-13", 7 pgs	
	"International Application Serial No. PCT/US2013/036964, Invitation to Pay Additional Fees and Partial Search Report mailed 08-02-13", 7 pgs	
	"International Application Serial No. PCT/US2013/036964, Written Opinion mailed 04-15-14", 10 pgs	
	"International Application Serial No. PCT/US2013/036964, Written Opinion mailed 11-29-13", 13 pgs	
	"International Application Serial No. PCT/US2014/019916, International Search Report mailed 10-13-14", 6 pgs.	
	"International Application Serial No. PCT/US2014/019916, Invitation to Pay Additional Fees and Partial Search Report mailed 05-30-14", 6 pgs	
	"International Application Serial No. PCT/US2014/019916, Written Opinion mailed 10-13-14", 13 pgs.	
	"Powdered Activated Carbon", Cabot Corp, [Online] retrieved from the internet: <http://www.cabotcorp.com/solutions/products-plus/activated-carbon/powdered>, (01/03/15), 3 pgs	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 16 of 19	Attorney Docket No: 4820.007US4	

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**
	"Response filed 09-04-17 to Notification Regarding Rule 164 and Article 94(3) EPC mailed 04-24-17", 7 pgs	
	ARENILLAS, A, et al., "CO2 removal potential of carbons prepared by co-pyrolysis of sugar and nitrogen containing compounds", Journal of analytical and applied pyrolysis 74.1, (2005), 298-306	
	BAKANDRITSOS, A., et al., "Aqueous and Gaseous Adsorption from Montmorillonite-Carbon Composites and from Derived Carbons", Langmuir, 21, (2005), 2349-2355	
	BAKANDRITSOS, A., et al., "High Surface Area Montmorillonite - Carbon Composites and Derived Carbons", Chemistry of Materials, Vol. 16, No. 8, (16 March 2004), 1551-1559	
	BIMER, JAN, et al., "Modified active carbons from precursors enriched with nitrogen functions: sulfur removal capabilities", (1998), 519-525	
	CHANG, SHIH-GER, "METHOD FOR OXIDATION OF MERCURY VAPOR", Provisional Application Serial No. 60/560,904, filed April 9, 2004, (04/09/04), 9 pgs.	
	CRISWELL, GORDON, et al., "Progress Report on Mercury Control Retrofit at the Colstrip Power Station", Paper #91, Mega Symposium, Baltimore, MD, (August 2011), 1-23	
	DARDER, M., et al., "Caramel-clay nanocomposites", Journal of Materials Chemistry, 15, (2005), 3913-3918	
	DIAMANTOPOULOU, LR G SKODRAS, et al., "Sorption of mercury by activated carbon in the presence of flue gas components", Fuel Processing Technology 91.2, (2010), 158-163	
	DONG, J., et al., "Mercury Removal from Flue Gases by Novel Regenerable Magnetic Nanocomposite Sorbents", Environ. Sci. Technol., 43, (2009), 3266-3271	
	DUNHAM, G. E., et al., "Mercury Capture by an Activated Carbon in a Fixed-Bed Bench-Scale System", Environmental Progress, 17(3), (1998), 203-208	
	EISAZADEH, H,, "Removal of Mercury from Water Using Polypyrrole and its Composites", Chinese Journal of Polymer Science, 25(4), (2007), 393-397	
	FELSVANG, K., et al., "Mercury Reduction and Control Options", The U.S. EPA-DOE-EPRI Combined Power Plant Air Pollutant Control Symposium; The Mega Symposium and The A&WMA Specialty Conference and Mercury Emissions: Fate, Effects and Control; Chicago, IL, (August, 2001), 1-19	
	FERNANDEZ-SAAVEDRA, R., et al., "Polymer-Clay Nanocomposites as Precursors of Nanostructured Carbon Materials for Electrochemical Devices: Templating Effect of Clays", Journal of Nanoscience and Nanotechnology, 8, (2008), 1741-1750	
	GHORBANI, M., et al., "Application of polyaniline nanocomposite coated on rice husk ash for removal of Hg(II) from aqueous media", Synthetic Metals, (2001), 4 pgs.	
	GHORISHI, BEHROOZ, et al., "Sorption of Mercury Species by Activated Carbons and Calcium-Based Sorbents: Effect of Temperature, Mercury Concentration and Acid Gases", Waste Manage. Res., 16:6, (1998), 582-593	
	GOMEZ-AVILES, A., et al., "Functionalized Carbon-Silicates from Caramel-Sepiolite Nanocomposites", Angew. Chem. Int. Ed., 46, (2007), 923-925	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 17 of 19	Attorney Docket No: 4820.007US4	

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	
	HA, et al., "Effect of unburnt carbon on the corrosion performance of fly ash cement mortar", Construction and Building Materials, (09/01/2005), 7 pgs	
	IKEUE, K., et al., "Noble-metal-containing nanoporous carbon synthesized within the interlayer space of montmorillonite and its catalytic property", Applied Catalysis A: General, 351, (2008), 68-74	
	KAWABUCHI, YUJI, et al., "Chemical vapor deposition of heterocyclic compounds over active carbon fiber to control its porosity and surface function", Langmuir 13.8, (1997), 2314-2317	
	KYOTANI, T., et al., "Formation of highly orientated graphite from polyacrylonitrile by using a two-dimensional space between montmorillonite lamellae", Nature, 331, (1988), 331-333	
	LANCIA, A., et al., "Adsorption of Mercuric Chloride Vapours from Incinerator Flue Gases on Calcium Hydroxide Particles", Combust. Sci. & Tech., 93, (1993), 277-289	
	LAUMB, JASON D., et al., "X-ray photoelectron spectroscopy analysis of mercury sorbent surface chemistry", Fuel Processing Technology, 85, (2004), 577-585	
	LI, Y., et al., "Removal of elemental mercury from simulated coal-combustion flue gas using a SiO2-TiO2 nanocomposite", Fuel Processing Technology, 89, (2008), 567-573	
	M, HOCQUEL, "Quecksilber und seine Verbindungen bei der Abfallverbrennung", with English Abstract pg 3, (12/31/2000), 112 pgs	
	MAROTO-VALER, M. MERCEDES, et al., "DEVELOPMENT OF ACTIVATED CARBONS FROM COAL AND BIOMASS COMBUSTION AND GASIFICATION CHARS", (2004), 2 pgs	
	MOCHIDA, I., et al., "Preparation of nitrogen containing pitches from quinoline and isoquinoline by AID of AlCl3", Carbon, 33(8), (1995), 1069-1077	
	NGUYEN-THANH, D., et al., "High Porosity Carbonaceous Adsorbents Templated From Porous Clay Heterostructures", Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem., 51(1), (2006), 7-8	
	NGUYEN-THANH, D., et al., "Metal-loaded carbonaceous adsorbents templated from porous clay heterostructures", Microporous and Mesoporous Materials, 92, (2006), 47-55	
	NICKELS, DALE L, et al., "Processing and reuse of activated carbon used to adsorb mercury from power plant flue gases", Final report, (2004)	
	OLSON, DAVID, et al., "The reduction of gas phase air toxics from combustion and incineration sources using the MET-Mitsui-BF activated coke process", Fule Processing Technology, (2000), 13 pgs	
	OLSON, DAVID G., et al., "The Reduction of Gas Phase Air Toxics from Combustion and Incineration Sources using the MET-Mitsui-BF Activated Coke Process", Fuel Processing Technology, 65-66, (2000), 393-405	
	OLSON, E. S., et al., "Catalytic effects of carbon sorbents for mercury capture", Journal of Hazardous Materials, 74, (2000), 61-79	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 18 of 19	Attorney Docket No: 4820.007US4	

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	
	PADAK, BIHTER, "Understanding mercury binding on activated carbon", Carbon 47.1 2, (2009), 2855-2864	
	PRZEPIORSKI, J, et al., "High temperature ammonia treatment of activated carbon for enhancement of CO2 adsorption", Applied Surface Science 225.1, (2004), 235-242	
	RACHEL, RIBEIROVIEIRA AZZI RIOS, et al., "Tailoring Activated Carbon by Surface Chemical Modification with O, S, and N Containing Molecules", Materials Research. 6 (2), (2003), 129-135	
	RAYMUNDO-PINERO, E, et al., "Structural characterization of N-containing activated carbon fibers prepared from a low softening point petroleum pitch and a melamine resin", Carbon 40.4, (2002), 597-608	
	SMOKEY, et al., "Alternative to Activated Carbon for Mercury Control", Power Engineering, (Oct 2012), 10 pgs	
	STRENG, SABINE, et al., "Toxics control by activated charcoal within the "System Dusseldorf" full scale experience", B. Fuel Processing Technology, (1994), 14 pgs	
	TSUJI, K, et al., "The Activated Coke Process for Combinded SOx/NOx/Air Toxics Reduction", Air and Water Management Assoc., (March 10, 1993), 27 pgs	
	VOSTEEN, B, et al., "Chlor-und Bromgestutzte Hg-Sorption an Elektrofilter-Flugaschen eines kohlegefeuerten Schmelzkammerkessels und an Zementrohmehl", Matin-Luther-Universitat Halle-Wittenberg, (2003), 1-30	
	VOSTEEN, B. W., et al., "", Flyer on Mercury Abatement given at the VDI-Wissensforum, Dusseldorf,Germany, (2003), 6 pgs.	
	VOSTEEN, B. W., "Bromine-enhanced Mercury Abatement from Combustion Flue Gases - Recent Industrial Applications and Laboratory Research", VGB PowerTech, Vol. 86, Issue 3/2006, (2006), 70-75	
	VOSTEEN, N., "Emissionsminderung von Quecksilber durch chlor- und bromgestutzte Hg-Oxidation in Rauchgas", (September 2003), 1-23	
	WAN, Q., et al., "Removal of gaseous elemental mercury over a CeO2-WO3/TiO2 nanocomposite in simulated coal-fired flue gas", Chemical Engineering Journal, 170, (2011), 512-517	
	WANG, B., et al., "Performance of a diatomite-based sorbent in removing mercury from aqueous and oil matrices", J. Environ. Eng. Sci., 6, (2007), 469-476	
	ZHANG, Y., et al., "High efficient removal of mercury from aqueous solution by polyaniline/humic acid nanocomposite", Journal of Hazardous Materials, 175, (2010), 404-409	
	ZHAO, YONGXIN, et al., "Effectsof Sulfur Dioxide and Nitric Oxide on Mercury Oxidation and Reducton under Homogeneous Conditions", J. Air & Waste Manage. Assoc., 56, (2006), 628-635	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 06/24/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 19 of 19	Attorney Docket No: 4820.007US4	

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
	ZHENG, YUANJING, et al., "Review of technologies for mercury removal from flue gas from cement production processes", Progress in Energy and Combustion Science, Vol. 38, No. 5, (26 April 2012), 599-629	
	ZHU, JIANZHONG, et al., "Enhanced mercury ion adsorption by amine-modified activated carbon", Journal of hazardous materials 166, (2009), 866-872	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 06/24/2018

* 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/

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 sorbent	US-PGPUB; USPAT	ADJ	ON	2015/03/17 13:50

		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 activated	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2016/09/29 16:22

		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

6/24/2018 1:43:18 PM
C:\Users\amillerharris\Documents\EAST\Workspaces\12429058.wsp

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

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 June 29, 2018. Please enter the following.

IN THE CLAIMS

Please amend the claims as follows:

1. (Canceled)

2. (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 Br_2, HBr, Br^-, or a combination thereof;

injecting a sorbent material 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;

reacting mercury in the mercury-containing gas with the promoted sorbent, to form a mercury/sorbent composition;

separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas;

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 a desired level.

3. (Previously Presented) The method of claim 2, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas.

4. (Previously Presented) The method of claim 2, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas on the sorbent.

5. (Previously Presented) The method of claim 2, wherein the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material.

6. (Previously Presented) The method of claim 2, wherein the combustion chamber comprises the halogen or halide promoter.

7. (Previously Presented) The method of claim 2, wherein a promoter precursor is on the coal, wherein the combusting of the coal forms the halogen or halide promoter in the mercury-containing gas.

8. (Previously Presented) The method of claim 2, wherein the promoter is reacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.

9. (Previously Presented) The method of claim 2, further comprising injecting a secondary material into the mercury-containing gas downstream of the combustion chamber.

10. (Previously Presented) The method of claim 9, wherein the secondary material comprises a halogen, a compound derived from a halogen, a hydrohalide, a compound comprising a Group V or Group VI element and a molecular halogen, or a combination thereof.

11. (Previously Presented) The method of claim 2, wherein the sorbent material injected into the mercury-containing gas further comprises a non-carbon sorbent material.

12. (Previously Presented) The method of claim 11, wherein the non-carbon sorbent material comprises at least one of a porous felsic material, a vesicular felsic material, a porous basaltic material, a vesicular basaltic material, a clay-based compound, an alkaline compound, a calcium hydroxide compound, a sodium acetate compound, and a bicarbonate compound.

13. (Previously Presented) The method of claim 2, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.

14. (Previously Presented) The method of claim 2, wherein the sorbent material injected into the mercury-containing gas is substantially free of halogen and halide promotion.

15. (Previously Presented) The method of claim 2, wherein the sorbent material is a product-promoted sorbent obtained by reaction of a base sorbent with another halogen or halide promoter.

16. (Previously Presented) The method of claim 2, wherein the combustion chamber comprises a boiler.

17. (Previously Presented) The method of claim 2, wherein the mercury-containing gas is a flue gas.

18. (Previously Presented) The method of claim 2, wherein the injection of the sorbent material into the mercury-containing gas occurs upstream of an air pre-heater.

19. (Previously Presented) The method of claim 2, wherein the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber.

20. (Canceled)

21. (Canceled)

REMARKS

This responds to the Non-Final Office Action dated June 29, 2018.

No claims are presently amended. Claims 20-21 are presently canceled, and claim 1 was canceled previously. No new claims are presently added. As a result, claims 2-19 are now pending in this application.

Allowed claims.

The Office Action states that claims 2-19 are allowed.

Applicant thanks the Examiner for indicating allowable subject matter.

The Rejection of Claims Under §102

I. The Office Action rejected claim 20 under pre-AIA 35 U.S.C. § 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. Patent No. 6,878,358 ("Vosteen").

This rejection is respectfully traversed.

Applicant notes that the office action states that claim 20 is rejected under § 102(b); however, the surrounding text refers to a §103(a) rejection and a combination of references is applied, none of which are identified as describing or suggesting all of the claimed features. Therefore, it is believed that the Examiner intended a §103(a) rejection.

The Office Action states that "…the Nelson reference discloses … reacting mercury in a mercury-containing gas with an injected in-flight promoted activated carbon sorbent to form a mercury/sorbent composition…." Applicant respectfully disagrees. Nelson mentions treatment of activated carbon with a bromine-containing gas (Abstract). However, the present application describes "in-flight" promotion as promotion of an injected activated carbon in a flue gas stream or in a transport line leading into the flue gas stream; see, the present application as originally filed at paragraphs [0025], [0027], [0030], [0072], [0077], [0092], [0098]. Nelson fails to describe or suggest promotion of an injected activated carbon in a flue gas stream or in a transport line leading into the flue gas stream. Like Nelson, Vosteen also fails to describe or suggest promotion of an injected activated carbon sorbent in a flue gas stream or in a transport line leading into the flue gas stream. Nelson and Vosteen, alone or together, fail to describe all the features of independent claim 20; therefore, this claim is patentable over this combination of references.

However, merely to expedite prosecution, while traversing and still disagreeing with the rejection for at least the reasons above, claim 20 is canceled.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 20 under pre-AIA 35 U.S.C. § 103(a) over Nelson in view of Vosteen.

II. The Office Action rejected claim 21 under pre-AIA 35 U.S.C. § 103(a) over U.S. patent publication no. 2004/0003716 ("Nelson") in view of U.S. Patent No. 6,878,358 ("Vosteen") and U.S. patent publication no. 2007/0168213 ("Comrie").

This rejection is respectfully traversed.

Applicant notes that the office action states that claim 21 is rejected under § 102(b); however, the surrounding text refers to a §103(a) rejection and a combination of references is applied, none of which are identified as describing or suggesting all of the claimed features. Therefore, it is believed that the Examiner intended a §103(a) rejection.

As explained herein at **I**, Nelson and Vosteen fail to describe or suggest all the features of independent claim 20. Comrie fails to remedy the deficiencies of Nelson and Vosteen. Nelson, Vosteen, and Comrie fail to describe or suggest all the features of independent claim 20; therefore, this claim is patentable over Nelson, Vosteen, and Comrie.

Claim 21 is dependent on independent claim 20. As such, claim 21 incorporates all the features of independent claim 20. Accordingly, claim 21 is patentable for at least the reasons given herein for patentability of independent claim 1.

However, merely to expedite prosecution, while traversing and still disagreeing with the rejection for at least the reasons above, claim 21 is canceled.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 21 under pre-AIA 35 U.S.C. § 103(a) over Nelson in view of Vosteen and Comrie.

Double Patenting Rejection

III. The Office Action rejected claims 20 and 21 for nonstatutory double patenting over claims 1 and 11 of U.S. patent no. 8,652,235.

Applicant does not admit that the claims are obvious in view of claims 1 and 11 of U.S. Patent No. 8,652,235. However, merely to expedite prosecution, claims 20 and 21 are presently canceled.

Applicant therefore respectfully requests that the rejection of claims 20 and 21 for nonstatutory double patenting over claims 1 and 11 of U.S. patent no. 8,652,235 be withdrawn.

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 13, 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.: 15/978,760	Group Art Unit: 1776
Filed: May 14, 2018	Docket: 4820.007US4
Customer No.: 21186	Confirmation No.: 6432

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 July 13, 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
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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-6,103,205	8/15/2000	Wojtowicz, Marek A, et al.
	US-6,284,199	9/4/2001	Downs, William, et al.
	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	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 07-02-18", 16 pgs	
	"Application Serial No. 14/712,558, Supplemental Amendment filed 06-13-2018", 14 pgs.	
	"Application Serial No. 15//974,343 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, 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. 15/589,359, 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.	
	"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

Electronic Patent Application Fee Transmittal

Application Number:	15978760
Filing Date:	14-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:	4820.007US4

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:	33170603
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
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:	4820.007US4
Receipt Date:	13-JUL-2018
Filing Date:	14-MAY-2018
Time Stamp:	11:51:07
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	071318INTEFSW00009235190743
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_007US4_NFOAR esponse_SIDS.pdf	207942 007bd3f955a5620132524e282433900a2ee 07792	yes	12
	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	9	
	Transmittal Letter		10	11	
	Information Disclosure Statement (IDS) Form (SB08)		12	12	
Warnings:					
Information:					
2	Non Patent Literature	4820001US7_Amend_2018061 3.pdf	147570 610b07480e7cd58352c4e20a1ff92328d8f5 a355	no	14
Warnings:					
Information:					
3	Non Patent Literature	4820003US2_AARN_05_18_18. pdf	136334 df4f1c5a49148acc27bb28c1a7f299722313f c27	no	14
Warnings:					
Information:					
4	Non Patent Literature	4820003US2_FOAR_06042018. pdf	448582 5e3e919f99d15c3515b0f22cae8c575bb29 df28c	no	13

Warnings:					
Information:					
5	Non Patent Literature	4820007US3_rspRR.pdf	138605 7690b8142f637529236cb30e3c32db3b38e5d35c	no	9
Warnings:					
Information:					
6	Non Patent Literature	15295594_Supplemental_pamd.pdf	123257 8e6de3bf1f47dd930d4e857019247aa0d128b6d2	no	10
Warnings:					
Information:					
7	Non Patent Literature	15974343_pamd.pdf	112273 1d634f082e56a9279a4abbf99efc1c5913a06678	no	7
Warnings:					
Information:					
8	Non Patent Literature	Supp_EU_Search_Rpt_1262012.pdf	71429 6be4fb2af74048d89e93afe9c44dd589a5f6bf96	no	2
Warnings:					
Information:					
9	Non Patent Literature	_4820001US7_OARN_07022018.pdf	1481651 5c033eec1083511b4041a3cba699121c0428ddb4	no	16
Warnings:					
Information:					
10	Non Patent Literature	_4820007US3_RERR_05222018.pdf	791713 8045cb88d988e0f5536f619bcfed4232eef119b4	no	6
Warnings:					
Information:					
11	Non Patent Literature	_4820007US3_RERR_06292018.pdf	732432 8b4ea2161349184cfc6efb0a044600bb7aed21f3	no	5
Warnings:					
Information:					

12	Fee Worksheet (SB06)	fee-info.pdf	30237 32607b8c859e6fbfd6fc9e3d9129237125db9d1f	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	4422025	

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.:	4820.007US4	Serial No.:	15/978,760
Filed:	May 14, 2018	Due Date:	September 29, 2018
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	6432

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 (8 pgs.)
X Supplemental Information Disclosure Statement (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (10).
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

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 15/978,760	Filing Date 05/14/2018	☐ 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), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $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	07/13/2018	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	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		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".	marsha R richards
*** 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.

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS			
Examiner Initial *	**USP Document Number**	**Publication Date**	**Name of Patentee or Applicant of cited Document**
	US-5,569,436	10/29/1996	Lerner, B. J.
	US-5,785,935	7/28/1998	Fristad, William E, et al.
	US-6,475,471	11/5/2002	Wehrli, Janet M
	US-20120244355A1	9/27/2012	Pollack, Nicholas R, et al.
	US-20180229182A1	8/16/2018	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. 15/295,594, Response filed 07-24-18 to Restriction Requirement mailed 06-29-18", 9 pgs.	
	"Application Serial No. 15/449,112, Notice of Allowance mailed 07-12-18", 8 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. 15/974,343, Non Final Office Action mailed 07-27-18", 12 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 07-27-18", 13 pgs	
	"Application Serial No. 15/997,091,Response filed 08-14-2018 to Non Final Office Action mailed 07-27-18", 10 pgs	
	"European Application Serial No. 14711106.6, Office Action mailed 06-05-18", 16 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:	15978760
Filing Date:	14-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Jordan Rivard Golomb/Jamie Johnson
Attorney Docket Number:	4820.007US4

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:	33592616
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	30-AUG-2018
Filing Date:	14-MAY-2018
Time Stamp:	17:04:40
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	083118INTEFSW00004127190743
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		15978760_SIDS_08-30-2018.pdf	302851 5fa0b56674886b14e5fae4df93b212ab7c2e8e0c	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_4820007us3_rrr1mo_072418.pdf	70585 f6031737cb6a686fb91372c85527fd87b6bffad	no	9
Warnings:					
Information:					
3	Non Patent Literature	0002_4820005us1_noar_07122018.pdf	1263995 17877f3f2bd3e7c8f3135aac33d7b0327374b2c4	no	8
Warnings:					
Information:					
4	Non Patent Literature	0003_4820003us2_aarn_072618.pdf	106699 dfd4aa1f5809c84f9cbc5d04c2cfbc139a98168f	no	14
Warnings:					
Information:					

5	Non Patent Literature	0004_4820001us9_oarn_07272018.pdf	1374025 727607f35a0d58bf905c628cbb62a783312584b3	no	12
Warnings:					
Information:					
6	Non Patent Literature	0005_4820001u10_oarnpe_07272018.pdf	1446593 98cc4c27651e714ad46e7ebd13c2d50980a2b938	no	13
Warnings:					
Information:					
7	Non Patent Literature	0006_4820001u10_rsp_20180814.pdf	89830 bff8f9e64b2dc6aa4f3477fe274976bc0a6e8385	no	10
Warnings:					
Information:					
8	Non Patent Literature	0007_4820003ep1_oarmisc_06052018.pdf	1691614 4c7bd04ea56eea29c4273688f078ddb97d378c15	no	16
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	30665 288753479d80fd2f4c400f8d66c8118fda02b2b3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	6376857		

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.:	4820.007US4	Serial No.:	15/978,760
Filed:	May 14, 2018	Due Date:	N/A
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	6432

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 (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (7).
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.:	15/978,760	Group Art Unit:	1776
Filed:	May 14, 2018	Docket:	4820.007US4
Customer No.:	21186	Confirmation No.:	6432
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

Respectfully submitted,

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

Date 8/30/2018 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.: 15/978,760	Group Art Unit: 1776
Filed: May 14, 2018	Docket: 4820.007US4
Customer No.: 21186	Confirmation No.: 6432

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 8/30/2018 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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/978,760	05/14/2018	Edwin S. Olson	4820.007US4

CONFIRMATION NO. 6432

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

PUBLICATION NOTICE



Title:SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Publication No.US-2018-0257031-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.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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

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	15978760
	Filing Date	2018-05-14
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.007US4

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					

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	20180257030	A1	2018-09-13	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]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15978760
	Filing Date	2018-05-14
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.007US4

	1	"Application Serial No. 15 974,343, Response filed 08-14-18 to Non Final Office Action mailed 07-27-18", 11 pgs	
	2	"Application Serial No. 14 712,558, Response filed 08-14-18 to Non Final Office Action mailed 07-02-18", 11 pgs	
	3	"Application Serial No. 15 382,114, Restriction Requirement mailed 08-28-18", 9 pgs	
	4	"Application Serial No. 15 589,359, Final Office Action mailed 09-12-18", 14 pgs	
	5	"Application Serial No. 15 382,114, Response filed 09-12-18 to Restriction Requirement mailed 08-28-18", 8 pgs.	
	6	"Application Serial No. 15 589,359, Response filed 09-14-18 to Final Office Action mailed 09-12-18", 18 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.

[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	15978760
	Filing Date	2018-05-14
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.007US4

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)	2018-09-24
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

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.

Electronic Patent Application Fee Transmittal

Application Number:	15978760
Filing Date:	14-May-2018
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Filer:	Jordan Rivard Golomb/Jamie Johnson
Attorney Docket Number:	4820.007US4

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:	33804030
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Jordan Rivard Golomb/Jamie Johnson
Filer Authorized By:	Jordan Rivard Golomb
Attorney Docket Number:	4820.007US4
Receipt Date:	24-SEP-2018
Filing Date:	14-MAY-2018
Time Stamp:	12:57:52
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	092418INTEFSW00012001190743
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	Non Patent Literature	0001_2_npl_4820003us2_aarf_091418_f.pdf	151483 03d3831aa44f067a20c9ffa8a0d74f544937c793	no	14
Warnings:					
Information:					
2	Non Patent Literature	0002_2_npl_4820003us2_foar_09122018_f.pdf	443891 433c384740413b091badeea2bd00923f26f57a1f	no	14
Warnings:					
Information:					
3	Non Patent Literature	0003_2_npl_4820004us1_rerr_08282018_f.pdf	321053 d1bc44448bbf43fe2e900164ff3d43ead4ef0ce0	no	9
Warnings:					
Information:					
4	Non Patent Literature	0004_2_npl_4820004us1_rrr1mo_091218_f.pdf	125678 265b452a0b28ead53d21ad50a979211f556e8c6f	no	8
Warnings:					
Information:					
5	Non Patent Literature	0005_2_npl_4820_001us7_aarn_08142018_f.pdf	139635 6bf45cc088a63344481ccc5498811985dbff53e9	no	11
Warnings:					
Information:					
6	Non Patent Literature	0006_2_npl_4820_001us9_aarn_08142018_f.pdf	136050 76907cd0fca26e09690273661f9c56805023bbad	no	11
Warnings:					
Information:					

7	Information Disclosure Statement (IDS) Form (SB08)	15978760_ids_09-24-2018.pdf	617267 96c68facc9135c8c5c34a329c779cfce3bdcee18	no	4
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	30665 efef7051a700913a6fdf59b7b42baa24b3b2d3d3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1965722		

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.
15/978,760	05/14/2018	Edwin S. Olson	4820.007US4	6432

21186 7590 10/10/2018

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
10/10/2018	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. 15/978,760	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 07/13/2018.

☐ 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) 2-19 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) 2-19 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 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.

Claim 7 is 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 combusting of the coal forming the halogen or halide promoter in the mercury-containing gas is not within the originally filed specification.

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).

Claims 2-19 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 2, the Felsvang et al. reference discloses a method of separating mercury from a mercury-containing gas, the method comprising: combusting coal in a combustion chamber (column 5,

lines 23-25), to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter (column 5, lines 60-65 and column 4, lines 42-45) injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber (column 6, lines 11-14 and column 6, lines 24-26) such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent (column 3, line 66-column 4, line 3, the interaction between the activated carbon and chloride component would inherently react to form the promoted sorbent); reacting mercury in the mercury-containing gas with the promoted sorbent, to form a mercury/sorbent composition (column 6, lines 20-23); separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas (column 5, lines 45-50); 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 a desired level (column 6, lines 42-47). The reference does not disclose the halogen or halide promoter comprising Br_2, HBr, Br^-, or a combination thereof.

The Nelson reference discloses the halogen or halide promoter comprising Br_2, HBr, Br^-, or a combination thereof can be used to promote activated carbon (Nelson paragraphs [0017] and [0041]).

It would have been obvious to one having ordinary skill before the invention was made to have modified the Felsvang et al. reference to either replace the Cl with or include in addition to the halogen or halide promoter comprising Br_2, 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.

For claims 3 and 4, the Felsvang et al. reference discloses the method comprises removing greater than 70 wt% of the mercury in the mercury-containing gas (examples 1, 3 and 4), while the reference does not explicitly state the method comprises removing greater than 70 wt% of the

mercury in the mercury-containing gas on the sorbent the reference only removes particulate (column 5, lies 50-55) so it would be apparent to one having ordinary skill in the art that the particulate would include the activated carbon reacted with the chloride having absorbed mercury (column 6, lines 26-28). Further claims 93 and 94 detail the result of the method steps. As the method steps are shown above, the result of performing said method steps of the reference would be similar or the same as that of the claimed results.

For claim 5, the Felsvang et al. reference does not explicitly state the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material. The reference does disclose optimizing the amount of Cl introduced (column 6, lines 42-46).

The Nelson reference discloses optimizing the amount 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 Felvang et al. reference to include the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material so as to adjust the about of halogen introduced based on the Hg content and to ensure optimum reaction between the halogen and the activated carbon (Nelson paragraph [0054]). 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 6, the Felsvang et al. reference discloses the combustion chamber comprises the halogen or halide promoter (column 4, lines 42-44 and column 6, lines 29-34).

For claim 7, the Felsvang et al. reference discloses a promoter precursor is on the coal, wherein the combusting of the coal forms the halogen or halide promoter in the mercury-containing gas (column 4, lines 51-58 and column 3, lines 53-56).

For claim 8, the Felsvang et al. reference discloses the promoter is reacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent (column 3, lines 53-56 and column 4, lines 39-59).

For claim 9, the Felsvang et al. reference discloses further comprising injecting a secondary material into the mercury-containing gas downstream of the combustion chamber (column 4, lines 42-47 and column 6, lines 24-39).

For claim 10, the Felsvang et al. reference discloses the secondary material comprises a halogen, a compound derived from a halogen, a hydrohalide, a compound comprising a Group V or Group VI element and a molecular halogen, or a combination thereof (column 4, lines 42-47 and column 6, lines 24-39).

For claims 11 and 12, the Felsvang et al. reference discloses the sorbent material injected into the mercury-containing gas further comprises a non-carbon sorbent material (column 5, lines 45-49) and the non-carbon sorbent material comprises at least one of a porous felsic material, a vesicular felsic material, a porous basaltic material, a vesicular basaltic material, a clay-based compound, an alkaline compound, a calcium hydroxide compound, a sodium acetate compound, and a bicarbonate compound (column 5, lines 45-49, column 4, lines 25-28 and column 5, lines 26-32).

For claim 13, the Felsvang et al reference discloses the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof (column 4, lines 5-18).

For claim 14, the Felsvang et al. reference discloses the sorbent material injected into the mercury-containing gas is substantially free of halogen and halide promotion (column 6, lines 29-35).

For claim 15, the Felsvang et al. reference discloses the sorbent material is a product-promoted sorbent obtained by reaction of a base sorbent with another halogen or halide promoter (column 4, lines ,39-50 and column 6, lines 19-42).

For claim 16, the Felsvang et al. reference discloses the combustion chamber comprises a boiler (column 5, lines 33-36).

For 17, the Felsvang et al. reference discloses the mercury-containing gas is a flue gas (column 5, lines 33-36).

For claim 18, the Felsvang et al. reference does not disclose the injection of the sorbent material into the mercury-containing gas occurs upstream of an air pre-heater.

The Nelson reference discloses the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber (figure 4, objects 71, 64 and 22 and paragraph [0062]).

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 the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber (Nelson figure 4, objects 71, 64 and 22 and paragraph [0062]) so the process can be used in a plant which has "hot-side" ESP and still have effective mercury capture.

For claim 19, the Nelson Felsvang et al. reference discloses the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber (figure, objects 4, 12, 14, 1 and 2).

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 2-19 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.

The current claim set corresponds to ‘286 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '286 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '147 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '147 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '655 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '655 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '819 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '819 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '689 expect combusting a fossil fuel in a combustion chamber to provide a mercury-containing gas, wherein the mercury containing gas comprises a halogen or halide promoter.

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 '689 reference to include a fossil fuel in a combustion chamber to provide a mercury-containing gas, wherein the mercury containing gas comprises a halogen or halide promoter. (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability within a fossil fuel operation.

Claims 2-19 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.

The current claim set corresponds to '886 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '886 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '235 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '235 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of copending Application No. 15/295594 ('594). 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 '594.

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

Claims 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 8-20 of copending Application No. 15/589359 ('359) in view of Felsvang et al. US 5,435,980.

The current claim set corresponds to '359 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '359 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine 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 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/853029 ('029). 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 '029.

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

Claims 2-19 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 '760.

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

Claims 2-19 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 2-19 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.

The current claim set corresponds to '114 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '114 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine 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 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/853029 ('029). 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 '029.

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 2-19 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. 15/978,760	Applicant(s)/Patent Under Reexamination	
	Examiner AMBER R ORLANDO	Art Unit 1776	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	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
*	M	US-7514052-B2	04-2009	Lissianski; Vitali Victor	B01D53/56	423/210

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

Notice of References Cited	Application/Control No. 15/978,760	Applicant(s)/Patent Under Reexamination	
	Examiner AMBER R ORLANDO	Art Unit 1776	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20090297413-A1	12-2009	Olson; Edwin S.	B01D53/10	423/215.5
*	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
*	F	US-20170239644-A1	08-2017	Olson; Edwin S.	B01D53/02	1/1
*	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					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/978,760	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**
IDS Search (EAST and DAV)	06/24/2018	AO
Inventor Search (DAV)	06/24/2018	AO
EAST searched for inflight promotion of sorbents.	06/24/2018	AO
EAST searched for inflight promotion of sorbents.	10/04/2018	AO

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/04 07:59
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,	US-PGPUB;	ADJ	ON	2015/03/17

		B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	USPAT			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 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;	ADJ	ON	2016/09/29 16:18

			IBM_TDB			
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; 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; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/11/16 11:27
S48	7	"20110023427"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2016/11/16 11:28

			DERWENT; 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,	US-PGPUB;	ADJ	ON	2016/11/16

		B01D2253/104, B01D2253/10, B01D53/10).cpc. and (halogen or halide of HBr) with sorbent	USPAT			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, 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" |	US-PGPUB; USPAT	ADJ	ON	2017/05/10 11:20

		"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.				
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 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;	ADJ	ON	2018/07/09

			USPAT; USOCR; FPRS; EPO; JPO			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
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

10/4/2018 8:07:05 AM
C:\Users\amillerharris\Documents\EAST\Workspaces\12429058.wsp

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-6,103,205	8/15/2000	Wojtowicz, Marek A, et al.
	US-6,284,199	9/4/2001	Downs, William, et al.
	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	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 07-02-18", 16 pgs	
	"Application Serial No. 14/712,558, Supplemental Amendment filed 06-13-2018", 14 pgs.	
	"Application Serial No. 15//974,343 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, 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. 15/589,359, 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.	
	"Supplementary European Search Report, dated December 6, 2012", 2 pgs	

EXAMINER /AMBER R ORLANDO/ DATE CONSIDERED 10/04/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS			
Examiner Initial *	**USP Document Number**	**Publication Date**	**Name of Patentee or Applicant of cited Document**
	US-5,569,436	10/29/1996	Lerner, B. J.
	US-5,785,935	7/28/1998	Fristad, William E, et al.
	US-6,475,471	11/5/2002	Wehrli, Janet M
	US-20120244355A1	9/27/2012	Pollack, Nicholas R, et al.
	US-20180229182A1	8/16/2018	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. 15/295,594, Response filed 07-24-18 to Restriction Requirement mailed 06-29-18", 9 pgs.	
	"Application Serial No. 15/449,112, Notice of Allowance mailed 07-12-18", 8 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. 15/974,343, Non Final Office Action mailed 07-27-18", 12 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 07-27-18", 13 pgs	
	"Application Serial No. 15/997,091,Response filed 08-14-2018 to Non Final Office Action mailed 07-27-18", 10 pgs	
	"European Application Serial No. 14711106.6, Office Action mailed 06-05-18", 16 pgs	

EXAMINER /AMBER R ORLANDO/ **DATE CONSIDERED** 10/04/2018

* 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/

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	15978760
Filing Date	2018-05-14
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.007US4

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					

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	20180257030	A1	2018-09-13	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]

/AMBER R ORLANDO/ 10/04/2018

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	15978760
	Filing Date	2018-05-14
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.007US4

	1	"Application Serial No. 15 974,343, Response filed 08-14-18 to Non Final Office Action mailed 07-27-18", 11 pgs	
	2	"Application Serial No. 14 712,558, Response filed 08-14-18 to Non Final Office Action mailed 07-02-18", 11 pgs	
	3	"Application Serial No. 15 382,114, Restriction Requirement mailed 08-28-18", 9 pgs	
	4	"Application Serial No. 15 589,359, Final Office Action mailed 09-12-18", 14 pgs	
	5	"Application Serial No. 15 382,114, Response filed 09-12-18 to Restriction Requirement mailed 08-28-18", 8 pgs.	
	6	"Application Serial No. 15 589,359, Response filed 09-14-18 to Final Office Action mailed 09-12-18", 18 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	10/04/2018

*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	15978760
Filing Date	2018-05-14
First Named Inventor	Edwin S. Olson
Art Unit	1776
Examiner Name	Amber Orlando
Attorney Docket Number	4820.007US4

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)	2018-09-24
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.**

/AMBER R ORLANDO/ 10/04/2018

EFS Web 2.1.17

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.

/AMBER R ORLANDO/ 10/04/2018

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

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

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 10, 2018. Please enter the following.

IN THE CLAIMS

Please amend the claims as follows:

1. (Canceled)

2. (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 [[Br_2,]]HBr, Br^-, or a combination thereof;

injecting a sorbent material 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;

reacting mercury in the mercury-containing gas with the promoted sorbent, to form a mercury/sorbent composition;

separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas;

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 a desired level.

3. (Previously Presented) The method of claim 2, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas.

4. (Previously Presented) The method of claim 2, comprising removing greater than 70 wt% of the mercury in the mercury-containing gas on the sorbent.

5. (Previously Presented) The method of claim 2, wherein the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material.

6. (Previously Presented) The method of claim 2, wherein the combustion chamber comprises the halogen or halide promoter.

7. (Currently Amended) The method of claim 2, wherein ~~a promoter precursor is on~~ the coal comprises added Br_2, HBr, Br^-, or a combination thereof, ~~wherein the combusting of the coal forms the halogen or halide promoter in the mercury-containing gas~~.

8. (Previously Presented) The method of claim 2, wherein the promoter is reacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.

9. (Previously Presented) The method of claim 2, further comprising injecting a secondary material into the mercury-containing gas downstream of the combustion chamber.

10. (Previously Presented) The method of claim 9, wherein the secondary material comprises a halogen, a compound derived from a halogen, a hydrohalide, a compound comprising a Group V or Group VI element and a molecular halogen, or a combination thereof.

11. (Previously Presented) The method of claim 2, wherein the sorbent material injected into the mercury-containing gas further comprises a non-carbon sorbent material.

12. (Previously Presented) The method of claim 11, wherein the non-carbon sorbent material comprises at least one of a porous felsic material, a vesicular felsic material, a porous basaltic material, a vesicular basaltic material, a clay-based compound, an alkaline compound, a calcium hydroxide compound, a sodium acetate compound, and a bicarbonate compound.

13. (Previously Presented) The method of claim 2, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.

14. (Previously Presented) The method of claim 2, wherein the sorbent material injected into the mercury-containing gas is substantially free of halogen and halide promotion.

15. (Previously Presented) The method of claim 2, wherein the sorbent material is a product-promoted sorbent obtained by reaction of a base sorbent with another halogen or halide promoter.

16. (Previously Presented) The method of claim 2, wherein the combustion chamber comprises a boiler.

17. (Previously Presented) The method of claim 2, wherein the mercury-containing gas is a flue gas.

18. (Previously Presented) The method of claim 2, wherein the injection of the sorbent material into the mercury-containing gas occurs upstream of an air pre-heater.

19. (Previously Presented) The method of claim 2, wherein the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber.

20.-21. (Canceled)

22. (New) The method of claim 2, wherein the coal comprises added halide sorbent enhancement additive.

REMARKS

This responds to the Non-Final Office Action dated October 10, 2018.

Claims 1 and 7 are presently amended. No claims are presently canceled, and claims 1 and 20-21 were canceled previously. New claim 22 is presently added. As a result, claims 2-19 and 22 are now pending in this application.

Claim 2 is presently amended to recite "…a halogen or halide promoter comprising [[Br_2,]]HBr, Br^-, or a combination thereof…."

Claim 7 is presently amended to recite "…wherein ~~a promoter precursor is on~~ the coal comprises added Br_2, HBr, Br^-, or a combination thereof…." Support can be found in the application as-filed at paragraphs [0050] (promoter can be bromide, Br^-), [0064] and [0088] (bromine, bromide, or HBr can be promoter), [0035] (promoter can be introduced upstream of the combustor), paragraphs [0098]-[0107] ("additive" can mean promoter), and FIG. 6 (the additive can be added to the coal).

New claim 22 recites "…wherein the coal comprises added halide sorbent enhancement additive." Support can be found at paragraphs [0098]-[0107] ("additive" can mean promoter), paragraph [0010] (the additives can be called "sorbent enhancement additives"), and FIG. 6 (the additive can be added to the coal).

No new matter is added via the amendments herein.

The Rejection of Claims Under §112

I. The Office Action rejected claim 7 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 "…[t]he combusting of the coal forming the halogen or halide promotor in the mercury-containing gas is not within the originally filed specification."

This rejection is respectfully traversed.

Claim 7 is presently amended to recite "…wherein ~~a promoter precursor is on~~ the coal comprises added Br_2, HBr, Br^-, or a combination thereof…."

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 7 under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph.

The Rejection of Claims Under §103

II. The Office Action rejected claims 2-19 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 **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.

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.

Claim 2 is presently amended to recite "…a halogen or halide promoter comprising [[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.

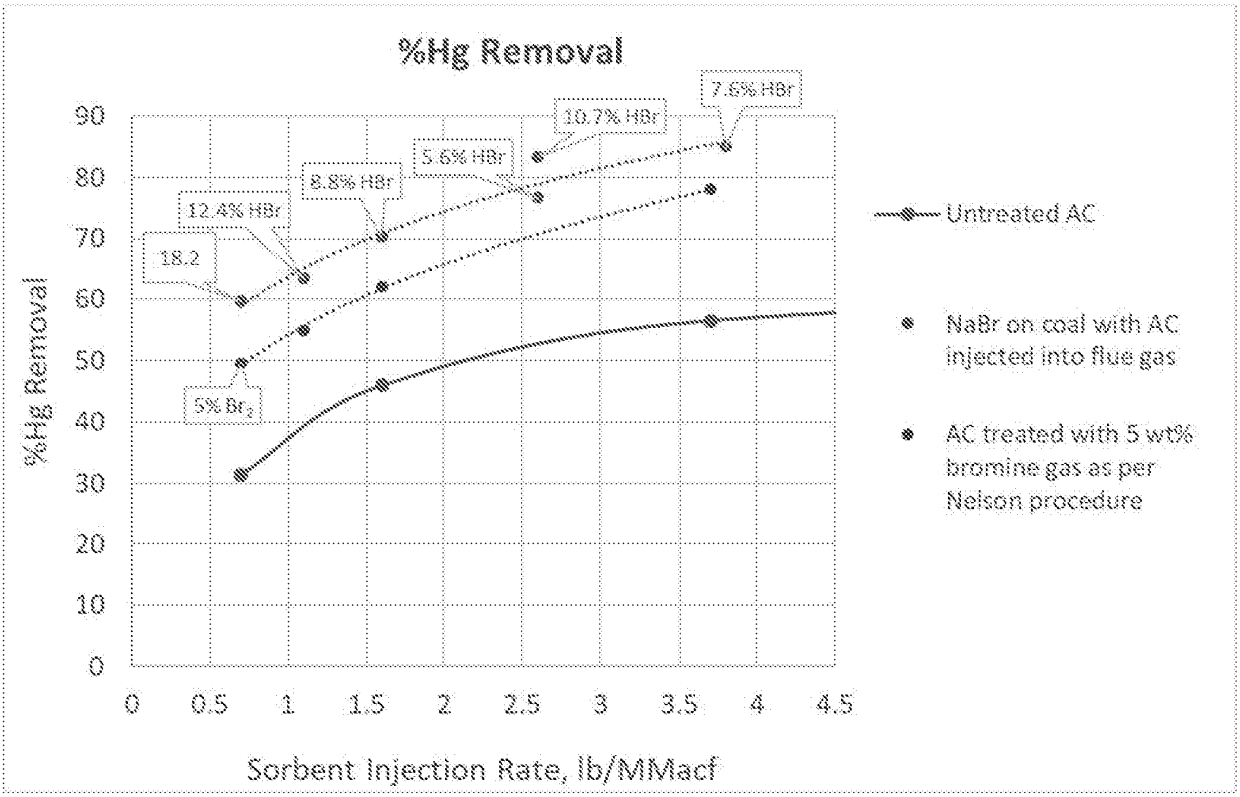
Nelson fails to describe or suggest that treatment of activated carbon with bromides such as HBr could provide any mercury-removal improvement, or even the same mercury-removal activity, compared to activated carbons treated with chlorides. Not only does Felsvang fail to describe or suggest that in-flight 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 2 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.

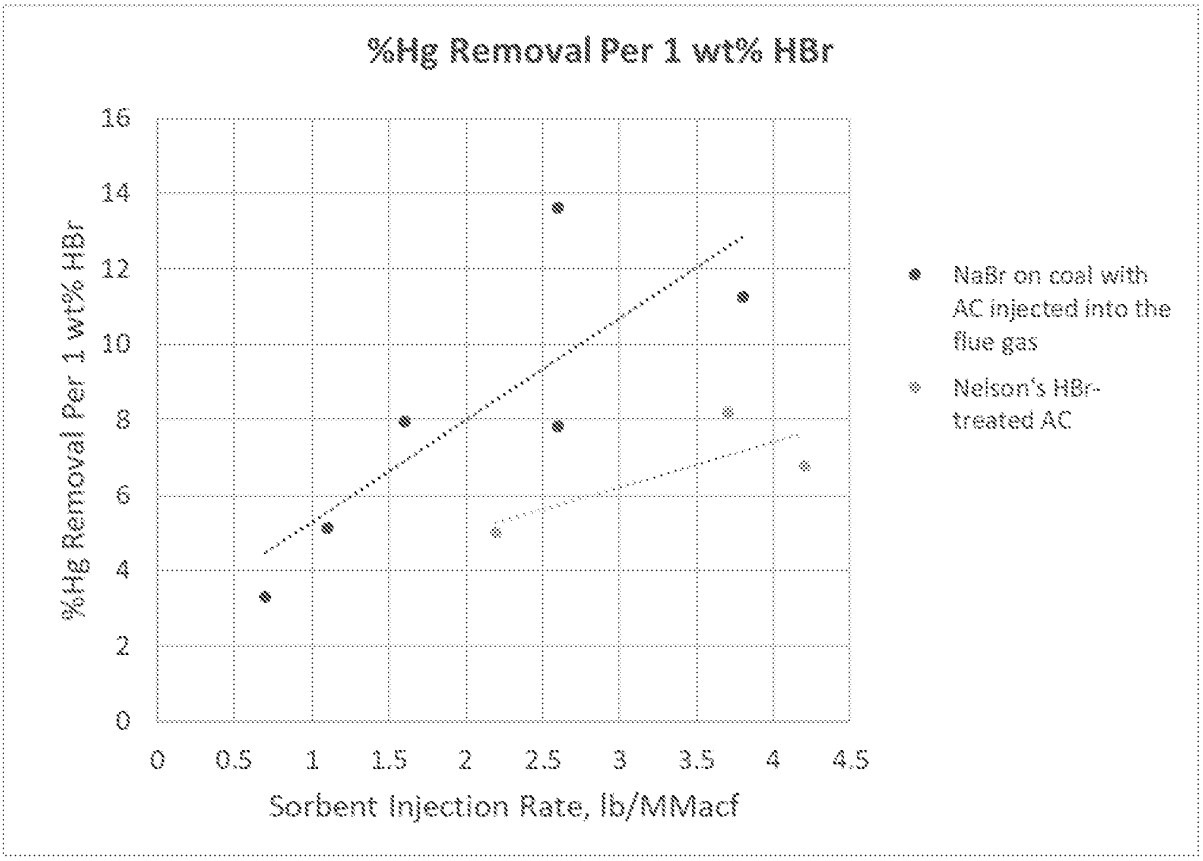
As explained in the 37 CFR § 1.132 declaration by John Pavlish filed herewith ("132 Declaration"), pilot-scale testing was performed with activated carbon alone (untreated) injected into the flue gas, the activated carbon treated with Br_2 outside the flue gas as per the Nelson procedure (see, 132 Declaration 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 132 Declaration at items 8-11. The plot given in the 132 Declaration at item 11 is reproduced below.



The data in the plot above from item 11 of the 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

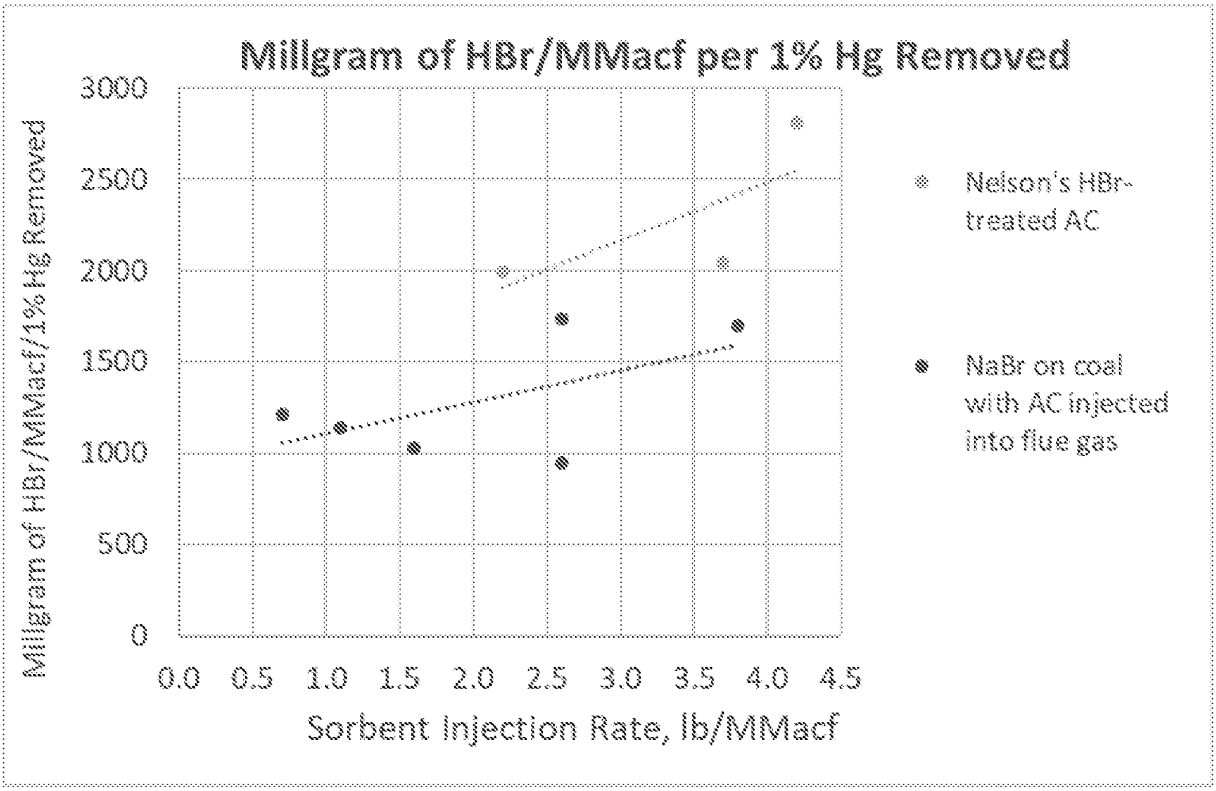
(in-flight promotion with Br^-) provided a higher percent of mercury removal at all tested sorbent injection rates as compared to the activated carbon alone (untreated) and compared to the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure. 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, 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 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 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, 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 132 Declaration at item 13 is reproduced below.



The data in the plot above, derived from the second plot at item 13 of the 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, 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.

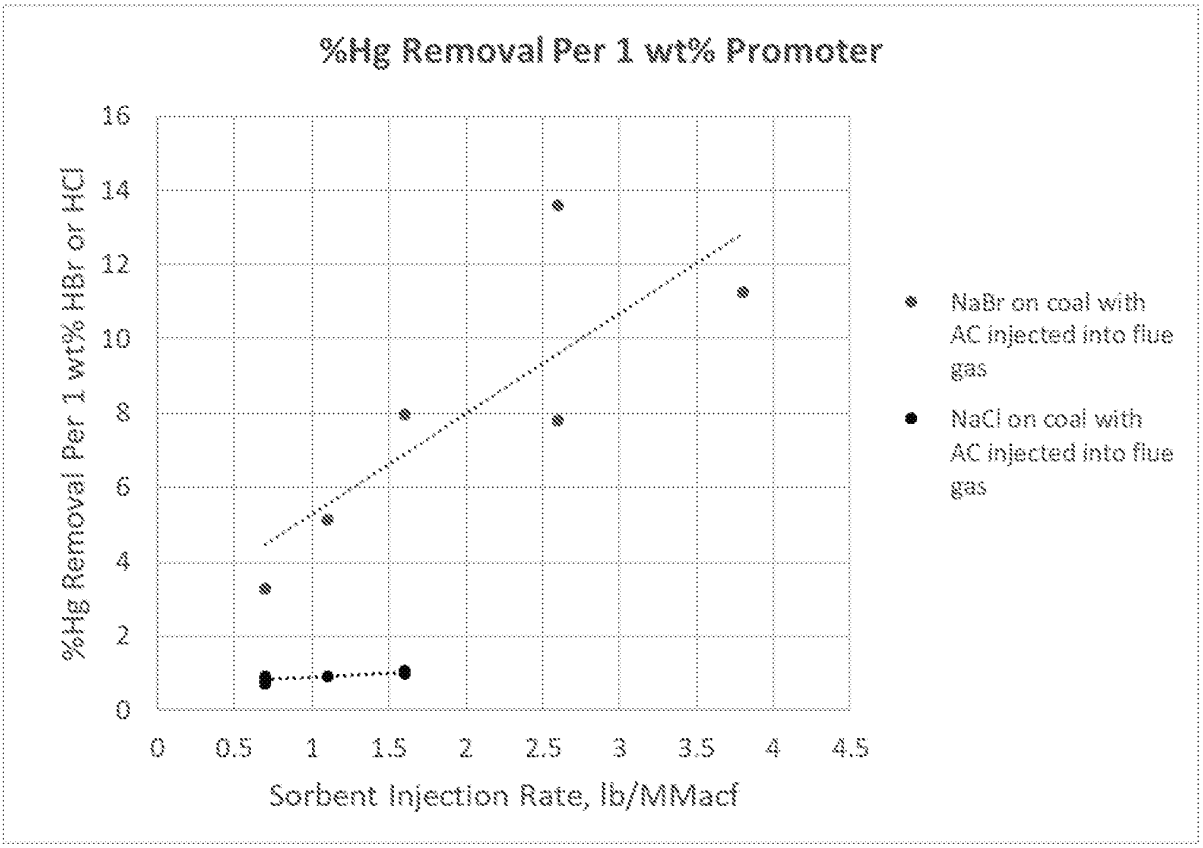
The only way that a person of ordinary skill in the art could discover that in-flight promotion of activated carbon with bromide promoters is more effective for mercury removal than bromide treatment outside the flue gas would not be from the cited references alone; instead, the person of ordinary skill 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 2 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 132 Declaration filed herewith, 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 132 Declaration at items 8-10. The first plot given in the 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 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, 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 2 is patentable over Felsvang in view of Nelson for at least this additional reason.

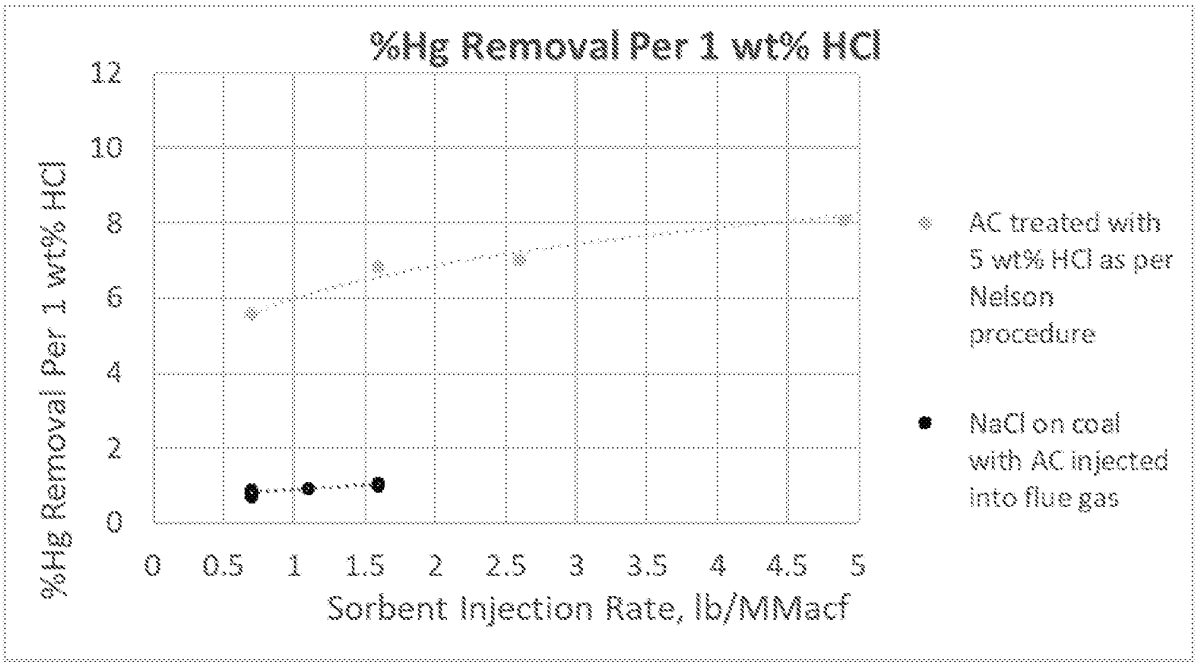
II(D). Even if a person of ordinary skill in the art compared the mercury removal of Felsvang's activated carbons promoted with chloride in the flue gas to activated carbons treated with HCl outside of the flue gas, they would not determine that in-flight promotion provides the same or better mercury 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 132 Declaration filed herewith, pilot-scale testing was performed with activated carbon treated with HCl outside the flue gas as per the Nelson procedure (see, 132

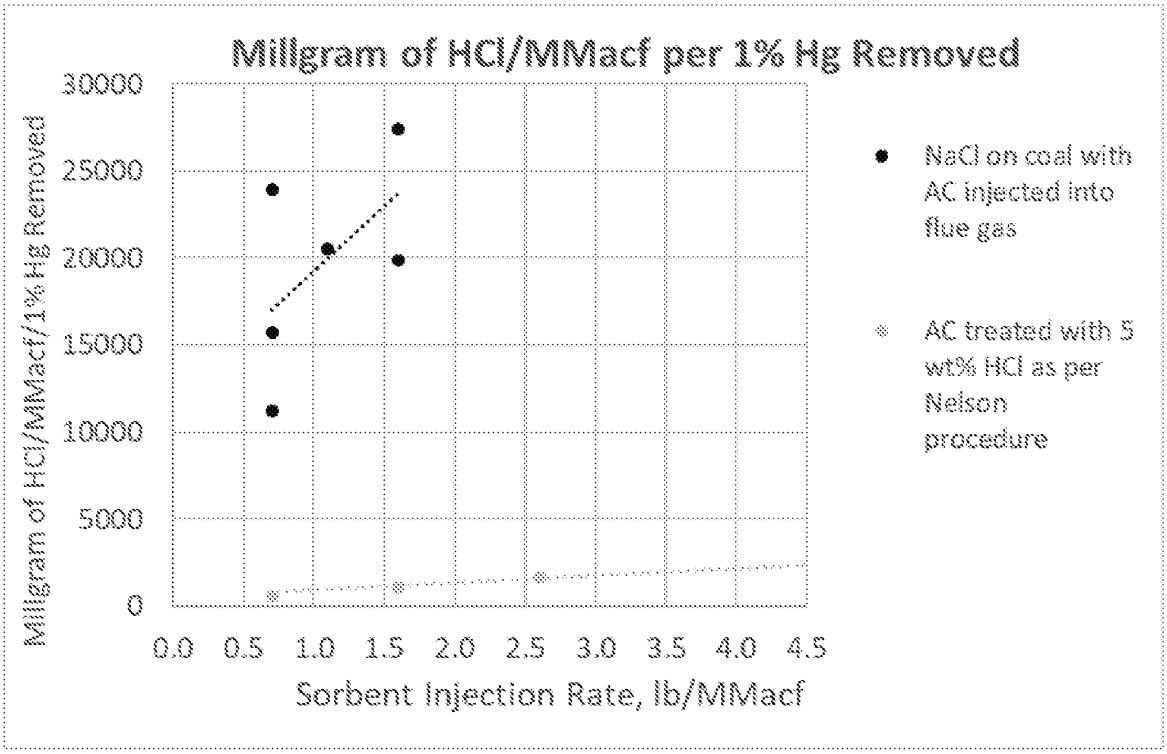
[2] In the event the Examiner intends to argue that such advantages are inherent in the cited art, Applicant notes that the claimed invention is not specifically disclosed in the prior art. The Examiner cannot reason inherency in a §103 context based on a mere proposed or hypothetical combination of features from cited references. Such reasoning would merely reflect the Examiner's reliance on impermissible hindsight. See, M.P.E.P. § 2112(IV).

Declaration 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 132 Declaration at items 8-10. The first plot given in the 132 Declaration at item 15 is reproduced below.



The data in the plot above from the item 15 of the 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, 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 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.

Dependent claims 3-19 are directly or indirectly dependent on independent claim 2. As such, these claims incorporate all the features of claim 2. Accordingly, claims 3-19 are patentable for at least the reasons given herein for patentability of independent claim 2.

Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claims 2-19 under 35 U.S.C. § 103(a) over Felsvang in view of Nelson.

Double Patenting Rejections

III(A). The Office Action rejected claims 2-19 for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-30 of U.S. patent no. 7,435,286 in view of Felsvang.

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.

III(B). The Office Action rejected claims 2-19 were rejected for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-25 of U.S. patent no. 8,168,147 in view of Felsvang.

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.

III(C). The Office Action rejected claims 2-19 were rejected for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-60 of U.S. patent no. 8,512,655 in view of Felsvang.

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.

III(D). The Office Action rejected claims 2-19 were rejected for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-60 of U.S. patent no. 8,821,819 in view of Felsvang.

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.

III(E). The Office Action rejected claims 2-19 were rejected for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-33 of U.S. patent no. 9,757,689 in view of Felsvang.

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.

III(F). The Office Action rejected claims 2-19 were rejected for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-20 of U.S. patent no. 9,468,886 in view of Felsvang.

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.

III(G). The Office Action rejected claims 2-19 were rejected for 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").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-30 of U.S. Patent No. 8,652,235 in view of Felsvang.

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.

III(H). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 1-16 of copending application no. 15/295594.

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-16 of copending application no. 15/295594.

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.

III(I). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 8-20 of copending application no. 15/589359 in view of U.S. patent no. 5,435,980 ("Felsvang").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 8-20 of copending application no. 15/589359 in view of Felsvang.

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.

III(J). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 1-20 of copending application no. 15/853029.

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-20 of copending application no. 15/853029.

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.

III(K). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 1-20 of copending application no. 14/712558.

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-20 of copending application no. 14/712558.

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.

III(L). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 1-20 of copending application no. 15/951970.

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-20 of copending application no. 15/951970.

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.

III(M). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 1-20 of copending application no. 15/382114 in view of U.S. patent no. 5,435,980 ("Felsvang").

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-20 of copending application no. 15/382114 in view of Felsvang.

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.

III(N). The Office Action rejected claims 2-19 were provisionally rejected for nonstatutory double patenting over claims 1-20 of copending application no. 15/853029.

This rejection is respectfully traversed. Applicant does not admit that claims 2-19 are obvious over claims 1-20 of copending application no. 15/853029. Applicant notes that this rejection is identical to the one reported herein at **III(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.

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.: 15/978,760	Group Art Unit: 1776
Filed: May 14, 2018	Docket: 4820.007US4
Customer No.: 21186	Confirmation No.: 6432

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
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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-4,013,516	3/22/1977	Greenfield, Charles, et al.
	US-4,699,896	10/13/1987	Sing, Kenneth S, et al.
	US-10,130,930	11/20/2018	Olson, Edwin S
	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. 15/295,594, Non Final Office Action mailed 10-23-18", 20 pgs	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 10-22-18", 12 pgs	
	"Application Serial No. 15/974,343, Non Final Office Action mailed 10-29-18", 22 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 11-02-18", 27 pgs	
	"European Application Serial No. 14711106.6, Response filed 10-15-18 to Office Action mailed 06-05-18", w/ English Claims, 15 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.: 15/978,760 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

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. 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 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. 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.

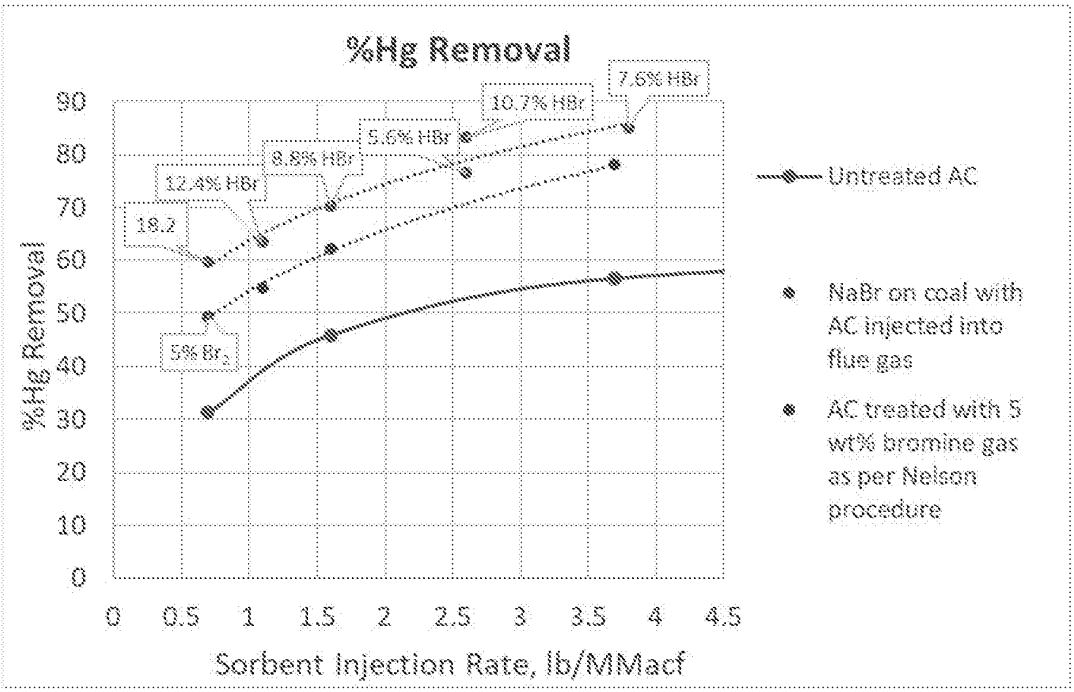
9. The results of the pilot-scale test with untreated activated carbon and with the activated carbon treated with Br_2 outside the flue gas described herein at item 6 are given in the table below.

Sample	Additive	Sorbent Description	Sorbent Injection Rate (lb/MMacf)	Br_2 or HCl 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

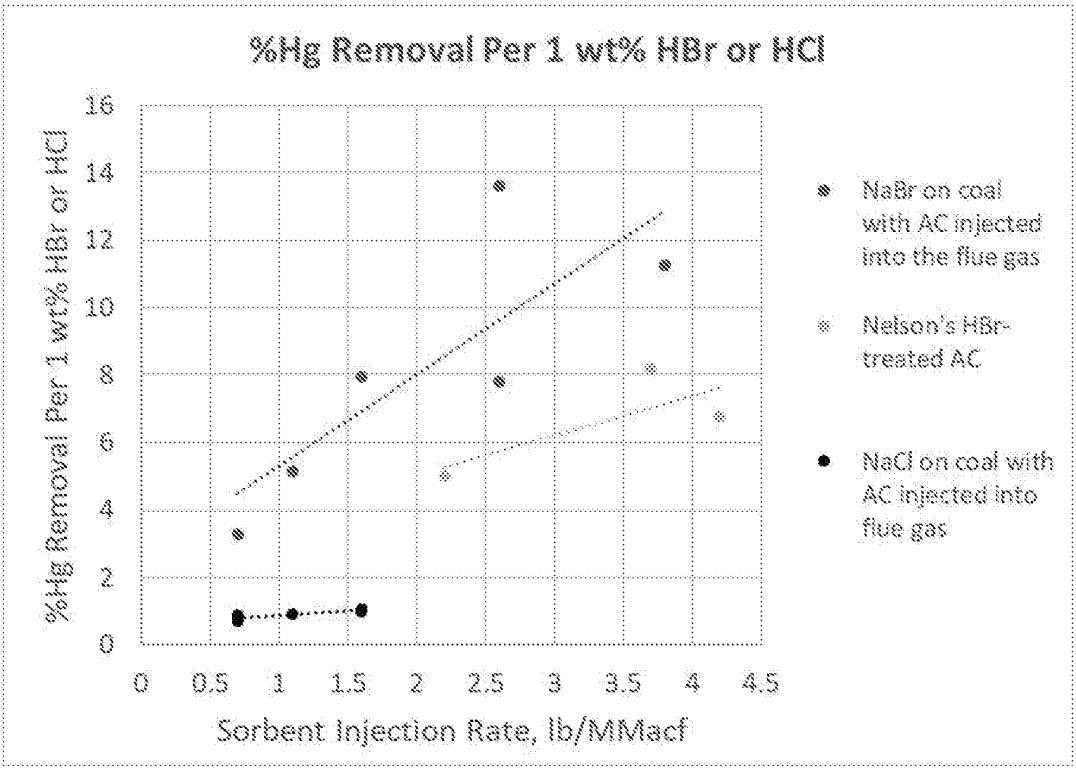
11. The following plot shows the percent mercury removal versus the sorbent injection rate for the activated carbon alone (untreated), the activated carbon treated with Br_2 outside the flue gas described herein at item 6 as per the Nelson procedure, and for NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas.

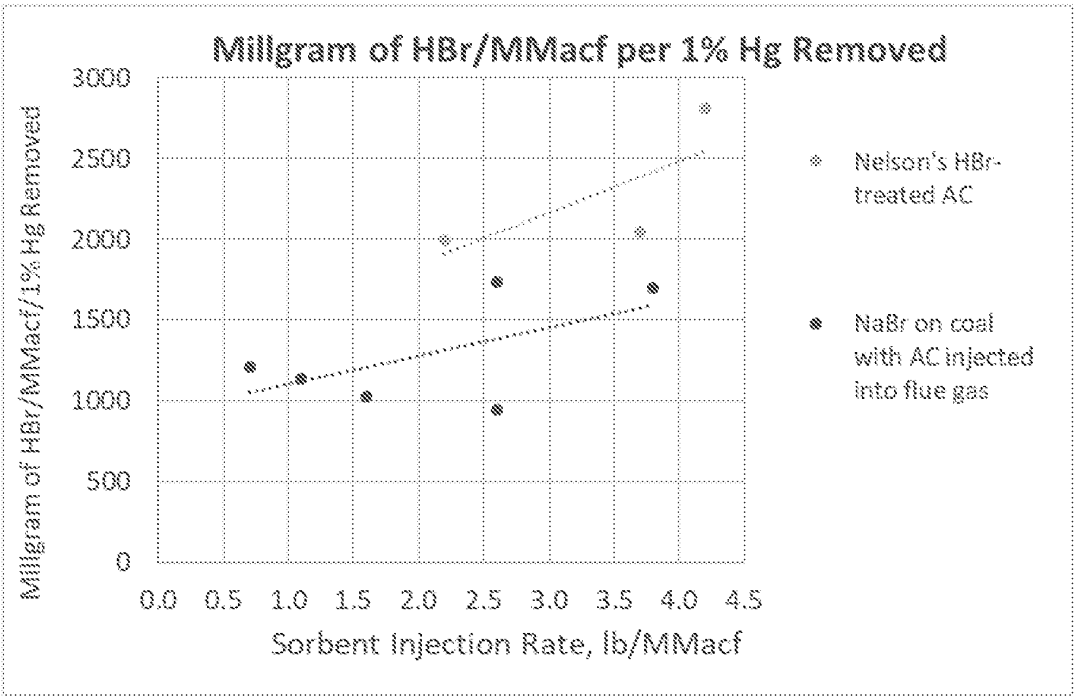


12. The data in the plot above show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas (in-flight promotion with Br^-) provided a higher percent of mercury removal at all tested sorbent injection rates as compared to the activated 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.

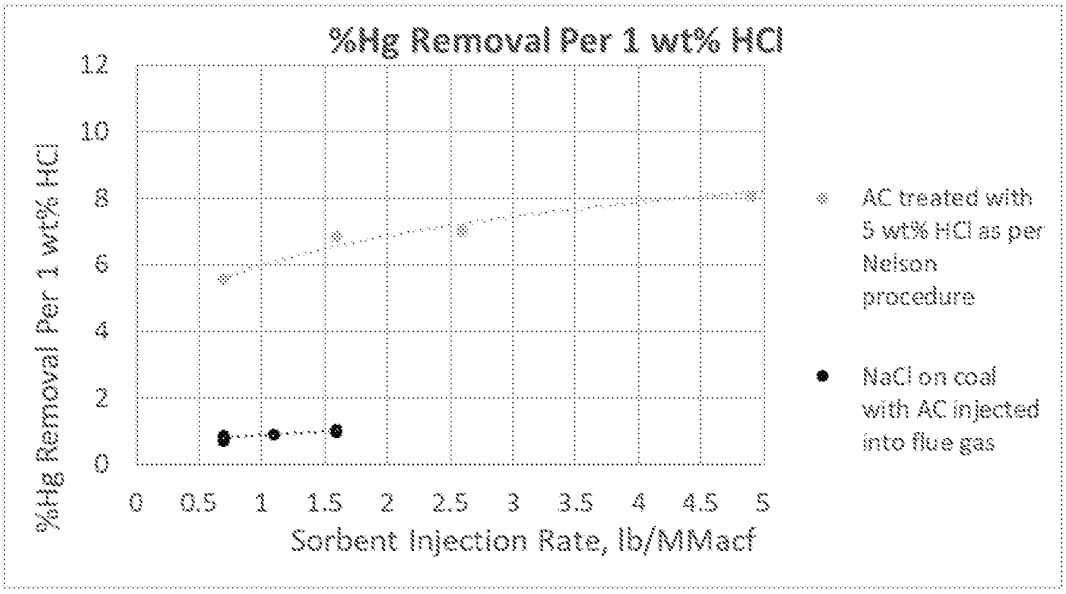
13. The following first plot shows the percent mercury removal per 1 wt% HBr or HCl versus the sorbent injection rate with NaBr or NaCl added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas, and for Nelson's activated carbon treated with HBr 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).

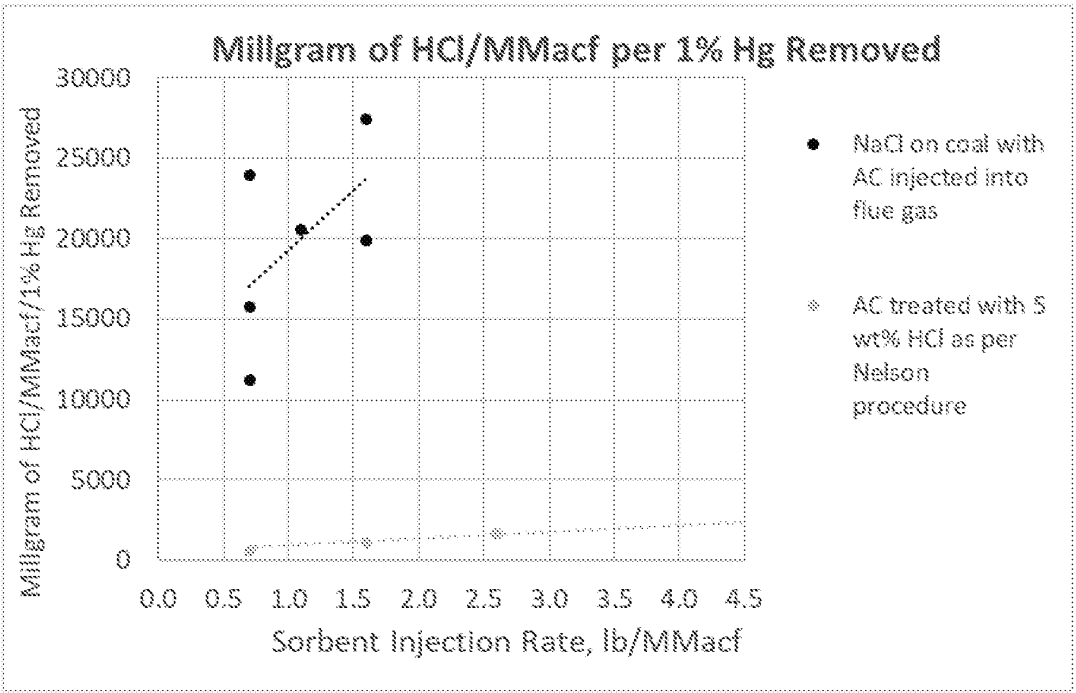




14. The data in the first plot above show that the NaBr added to coal prior to introduction to the furnace with injection of untreated activated carbon into the flue gas provided a significantly higher (about 2x) percent mercury removal per 1 wt% HBr at all tested sorbent injection rates as compared 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.





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: December 3, 2018 By: John Pavlish

John Pavlish

Electronic Patent Application Fee Transmittal

Application Number:	15978760
Filing Date:	14-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:	4820.007US4

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:	34470564
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
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:	4820.007US4
Receipt Date:	03-DEC-2018
Filing Date:	14-MAY-2018
Time Stamp:	17:59:31
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	120418INTEFSW00005157190743
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_007US4_NFOAR espSIDS_Dec.pdf	1242828 dd297bb0a2fea200c7e1e961953278d6ef430e5f	yes	41

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	26
Transmittal Letter	27	28
Information Disclosure Statement (IDS) Form (SB08)	29	29
Affidavit-traversing rejectns or objectns rule 132	30	41

Warnings:

Information:

2	Non Patent Literature	4820_001US7_OARN_10192018.pdf	4575545 3f6078548961a8f8aeaa2866bca8cbdb600fc0d6	no	35

Warnings:

Information:

3	Non Patent Literature	4820001U10_OARNPE_11022018.pdf	2761437 3f0306c66f86ac35999744ecb333c449ee456a82	no	27

Warnings:

Information:

4	Non Patent Literature	4820001US7_OARN_10192018.pdf	2852544 d7bf37cedde5afb5e92e828f83ba6ae4f9e2f472	no	26
Warnings:					
Information:					
5	Non Patent Literature	4820001US9_OARNPE_10292018.pdf	2276933 b63c75fe3f8ee9404538732 4486e0c1d59ab76c7	no	22
Warnings:					
Information:					
6	Non Patent Literature	4820003EP1AARN20181015.pdf	21254683 906b5733e4e49b01db00980a5e144e2713381f13	no	15
Warnings:					
Information:					
7	Non Patent Literature	4820003US2_OARN_10222018.pdf	993980 c57ea9f66110edb41e637ab48060d9f4df70ad9d	no	12
Warnings:					
Information:					
8	Non Patent Literature	4820007US3_OARN_10232018.pdf	2099174 b093eb1f79549f5f4d1cc6108a8e68fc09bd913d	no	20
Warnings:					
Information:					
9	Non Patent Literature	Pietrzak_PrepartionofNitrogen.pdf	219945 362166e32af340b7ef32276c63d95469220d3e49	no	6
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	30237 364f1dfd9eca1a911a5978fa6945ed60933b9fd7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	38307306		

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.:	4820.007US4	Serial No.:	15/978,760
Filed:	May 14, 2018	Due Date:	January 10, 2019
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	6432

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 (25 pgs.)
X Supplemental Information Disclosure Statement (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).
X Declaration Under 37 C.F.R. § 1.132 (12 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

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 15/978,760	Filing Date 05/14/2018	☐ 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), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $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	12/03/2018	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	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		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".	/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.	

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.

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.
15/978,760	05/14/2018	Edwin S. Olson	4820.007US4	6432

21186 7590 12/26/2018

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
12/26/2018	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.** 15/978,760	**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) 2-19 and 22 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) 2-19 and 22 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).

Claims 2-19 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 2, the Felsvang et al. reference discloses a method of separating mercury from a mercury-containing gas, the method comprising: combusting coal in a combustion chamber (column 5, lines 23-25), to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter (column 5, lines 60-65 and column 4, lines 42-45) injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber (column 6, lines 11-14 and column 6, lines 24-26) such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent (column 3, line 66-column 4, line 3, the interaction between the activated carbon and chloride component would inherently react to form the promoted sorbent); reacting mercury in the mercury-containing gas with the promoted sorbent, to form a mercury/sorbent composition (column 6, lines 20-23); separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas (column 5, lines 45-50); 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 a desired level (column 6, lines 42-47). The reference does not disclose the halogen or halide promoter comprising HBr, Br^-, or a combination thereof.

The Nelson reference discloses the halogen or halide promoter comprising HBr, Br^-, or a combination thereof can be used to promote activated carbon (Nelson paragraphs [0017] and [0041]).

It would have been obvious to one having ordinary skill before the invention was made to have modified the Felsvang et al. reference 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.

For claims 3 and 4, the Felsvang et al. reference discloses the method comprises removing greater than 70 wt% of the mercury in the mercury-containing gas (examples 1, 3 and 4), while the reference does not explicitly state the method comprises removing greater than 70 wt% of the mercury in the mercury-containing gas on the sorbent the reference only removes particulate (column 5, lies 50-55) so it would be apparent to one having ordinary skill in the art that the particulate would include the activated carbon reacted with the chloride having absorbed mercury (column 6, lines 26-28). Further claims 93 and 94 detail the result of the method steps. As the method steps are shown above, the result of performing said method steps of the reference would be similar or the same as that of the claimed results.

For claim 5, the Felsvang et al. reference does not explicitly state the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material. The reference does disclose optimizing the amount of Cl introduced (column 6, lines 42-46).

The Nelson reference discloses optimizing the amount 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 Felvang et al. reference to include the promoted sorbent comprises about 1 g to about 30 g of the halogen or halide promoter per 100 g of the sorbent material so as to adjust the about of halogen introduced based on the Hg content and to ensure optimum reaction between the halogen

and the activated carbon (Nelson paragraph [0054]). 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 6, the Felsvang et al. reference discloses the combustion chamber comprises the halogen or halide promoter (column 4, lines 42-44 and column 6, lines 29-34).

For claims 7 and 22, the Felsvang et al. reference discloses the coal comprises added HBr, Br^-, or a combination thereof, and the coal comprises added halide sorben enhancement additive (column 4, lines 39-58 and column 3, lines 53-56).

For claim 8, the Felsvang et al. reference discloses the promoter is reacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent (column 3, lines 53-56 and column 4, lines 39-59).

For claim 9, the Felsvang et al. reference discloses further comprising injecting a secondary material into the mercury-containing gas downstream of the combustion chamber (column 4, lines 42-47 and column 6, lines 24-39).

For claim 10, the Felsvang et al. reference discloses the secondary material comprises a halogen, a compound derived from a halogen, a hydrohalide, a compound comprising a Group V or Group VI element and a molecular halogen, or a combination thereof (column 4, lines 42-47 and column 6, lines 24-39).

For claims 11 and 12, the Felsvang et al. reference discloses the sorbent material injected into the mercury-containing gas further comprises a non-carbon sorbent material (column 5, lines 45-49) and the non-carbon sorbent material comprises at least one of a porous felsic material, a vesicular felsic material, a porous basaltic material, a vesicular basaltic material, a clay-based compound, an alkaline compound, a calcium hydroxide compound, a sodium acetate compound, and a bicarbonate compound (column 5, lines 45-49, column 4, lines 25-28 and column 5, lines 26-32).

For claim 13, the Felsvang et al reference discloses the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof (column 4, lines 5-18).

For claim 14, the Felsvang et al. reference discloses the sorbent material injected into the mercury-containing gas is substantially free of halogen and halide promotion (column 6, lines 29-35).

For claim 15, the Felsvang et al. reference discloses the sorbent material is a product-promoted sorbent obtained by reaction of a base sorbent with another halogen or halide promoter (column 4, lines ,39-50 and column 6, lines 19-42).

For claim 16, the Felsvang et al. reference discloses the combustion chamber comprises a boiler (column 5, lines 33-36).

For 17, the Felsvang et al. reference discloses the mercury-containing gas is a flue gas (column 5, lines 33-36).

For claim 18, the Felsvang et al. reference does not disclose the injection of the sorbent material into the mercury-containing gas occurs upstream of an air pre-heater.

The Nelson reference discloses the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber (figure 4, objects 71, 64 and 22 and paragraph [0062]).

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 the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber (Nelson figure 4, objects 71, 64 and 22 and paragraph [0062]) so the process can be used in a plant which has "hot-side" ESP and still have effective mercury capture.

For claim 19, the Nelson Felsvang et al. reference discloses the injection of the sorbent material into the mercury-containing gas occurs upstream of a particulate separator or a scrubber (figure, objects 4, 12, 14, 1 and 2).

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 2-19 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.

The current claim set corresponds to '286 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '286 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '147 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '147 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '655 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '655 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '819 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '819 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '689 expect combusting a fossil fuel in a combustion chamber to provide a mercury-containing gas, wherein the mercury containing gas comprises a halogen or halide promoter.

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 '689 reference to include a fossil fuel in a combustion chamber to provide a mercury-containing gas, wherein the mercury containing gas comprises a halogen or halide promoter. (Felsvang et al. column 5, 60-65

and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability within a fossil fuel operation.

Claims 2-19 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.

The current claim set corresponds to '886 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '886 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 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.

The current claim set corresponds to '235 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '235 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine content of the system so as to increase the mercury sorption capability.

Claims 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of copending Application No. 15/295594 ('594). 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 '594.

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

Claims 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 8-20 of copending Application No. 15/589359 ('359) in view of Felsvang et al. US 5,435,980.

The current claim set corresponds to '359 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '359 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine 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 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of copending Application No. 15/853029 ('029). 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 '029.

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

Claims 2-19 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 '760.

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

Claims 2-19 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 2-19 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.

The current claim set corresponds to '114 expect for the mercury containing gas comprises a halogen or halide promoter.

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 '114 reference to include the mercury containing gas comprises a halogen or halide promoter (Felsvang et al. column 5, 60-65 and column 4, lines 42-45) so as to supplement the chlorine 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 2-19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over 1-20 of copending Application No. 15/853029 ('029). 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 '029.

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 claim 7 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(B)(1). The applicant contends that the bromide pormoters 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 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 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 12 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 13 compares HBr treated AC and NaBr on coal with AC injected into flue gas. The graph states Millgram 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 18 and 19, 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.

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 the Nelson reference.

Section 6 details a bromine treated activated carbon.

Section 7 details an HCl-treated activated carbon.

Section 8-10 detail an experiment and results of combusting coal and then exposing the exhaust of the combustion to bromine activated carbon, only activated carbon and HCl treated activated carbon.

Section 11 discloses a graph comparing NaBr on coal, AC treated with 5wt% bromine gas and untreated AC.

Section 12, the declarant contends that the data provided show that NaBr added to coal prior to introduction to the furnace in the current invention provided a higher percent of mercury removal than compared to the activated carbon treated the Br_2 outside of the flue gas as in the Nelson reference.

In response this contention does not overcome the rejection of record as 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 and not NaBr as asserted. 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 labeling on what the promoter is. None of the data point include what amount is being specified, wt%, vol% etc. Further the comparisons between the prior art and that of the current invention do no demonstrate unexpected results. 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. The results are not commensurate with the scope of the claim as the claims do 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.

Section 13 details the percent mercury removal per 1 wt% HBR or HCl and Milligram of HBr/MMacf per 1@ Hg removed.

Section 14, the declarant contends that the NaBr added to coal prior to introduction to the furnace results in a significantly higher percent mercury removal than that of Nelson's activated carbon treated with HBr outside of the flue gas. The declarant further contends that NaBr added to coal prior to introduction to the furnace provided a significantly lower milligrams of HBr/MMacf per 1% mercury removal when compared to Nelsons activated carbon treated with HBr outside of the flue gas.

The examiner asserts that these results do not overcome the rejection as claimed as they are not commensurate with the scope of the claim and do not present factual evidence germane to the patentability. The first graph has HBr treated AC compared to NaCl on coal with AC injected into flue gas. 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 or HBr which is not included in one set (NaCl) of the data points so it is unclear how the data points are being obtained. The second graph includes Nelson's HBr treated AC compared to NaBr on coal with AC injected into flue gas. Clearly the amount of HBr (y-axis) would be lower for the NaBr as NaBr on coal with AC injected into flue gas noes not include HBr. It is unclear how the NaBr on coal with AC inject into flue gas has any amount of HBr. Lastly 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.

Section 15 details the % Hg Removal Per 1wt% HCl and Milligram of HCl/MMacf per 1% Hg Removed.

Section 16, the declarant contends that activated carbon treated with HCl outside the flue gas provided a much higher percent of mercury removal than compared to NaCl added to coal prior to introduction to the furnace. The declarant further contends 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 in the flue gas was higher than that of activated carbon treated with HCl outside the flue gas.

The examiner asserts that these results do not overcome the rejection as claimed as they are not commensurate with the scope of the claim and do not present factual evidence germane to the patentability. The graphs have 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.

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
	15/978,760	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
IDS Search (EAST and DAV)	06/24/2018	AO
Inventor Search (DAV)	06/24/2018	AO
EAST searched for inflight promotion of sorbents.	06/24/2018	AO
EAST searched for inflight promotion of sorbents.	10/04/2018	AO
EAST searched for inflight promotion of sorbents.	12/19/2018	AO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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
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	2	"20060185335"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/18 16:12
S203	30	plug$4 with porosity with heat capacity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/18 17:04
S204	6	plug$4 with pore (size or diameter) with heat capacity	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/18 17:05
S205	67	plug$4 with pore (size or diameter) with thermal	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/18 17:06

12/19/2018 11:05:47 AM
C:\Users\amillerharris\Documents\EAST\Workspaces\12429058.wsp

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-4,013,516	3/22/1977	Greenfield, Charles, et al.
	US-4,699,896	10/13/1987	Sing, Kenneth S, et al.
	US-10,130,930	11/20/2018	Olson, Edwin S
	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. 15/295,594, Non Final Office Action mailed 10-23-18", 20 pgs	
	"Application Serial No. 15/589,359, Non Final Office Action mailed 10-22-18", 12 pgs	
	"Application Serial No. 15/974,343, Non Final Office Action mailed 10-29-18", 22 pgs	
	"Application Serial No. 15/997,091, Non Final Office Action mailed 11-02-18", 27 pgs	
	"European Application Serial No. 14711106.6, Response filed 10-15-18 to Office Action mailed 06-05-18", w/ English Claims, 15 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 12/19/2018

* 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/

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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

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**
	"Canadian Application Serial No. 2,904,039, Office Action mailed 02-18-19", 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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Edwin S. Olson et al.	Examiner: Amber Orlando
Serial No.: 15/978,760	Group Art Unit: 1776
Filed: May 14, 2018	Docket: 4820.007US4
Customer No.: 21186	Confirmation No.: 6432

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. § 1.98(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
NPL:jj 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	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1	Attorney Docket No: 4820.007US4	

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. 15/974,343, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-29-18", 37 pgs	
	"Application Serial No. 15/974,343, Final Office Action mailed 01-14-19", 25 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 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:	15978760
Filing Date:	14-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:	4820.007US4

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:	35258431
Application Number:	15978760
International Application Number:	
Confirmation Number:	6432
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:	4820.007US4
Receipt Date:	26-FEB-2019
Filing Date:	14-MAY-2018
Time Stamp:	16:54:08
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	022719INTEFSW00004077190743
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		15978760_SIDS_02-26-2019.pdf	292660 9855231eefe4d9afb3f574e4e30615d038480d10	yes	8

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
Transmittal Letter	6	7
Information Disclosure Statement (IDS) Form (SB08)	8	8

Warnings:

Information:

2	Non Patent Literature	0001_2_npl_4820001u10_foar_01112019_f.pdf	891808 6ba80c712a7452b16b3f246717479bd8f0a1d443	no	20

Warnings:

Information:

3	Non Patent Literature	0002_2_npl_4820001u10_response_f.pdf	915746 b3ee64642d401e51a12318a0f2bc112ce13b1294	no	40

Warnings:

Information:

4	Non Patent Literature	0003_2_npl_4820001us7_aarn_120318_f.pdf	645370 4b6d7a942ae0897c15729f380b130074cd567f03	no	28

Warnings:					
Information:					
5	Non Patent Literature	0004_2_npl_4820001us7_foar_01112019_f.pdf	1277410 7245c7f23fe880d8b4bd15b074dade2ff580150a	no	27
Warnings:					
Information:					
6	Non Patent Literature	0005_2_npl_4820001us9_foar_01142019_f.pdf	1164983 55992c8bd625dbd9c2066b62330af4b8c211bdef	no	25
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_4820003ca1_oarmisc_02182019_f.pdf	557901 f71ed0936bba9662fc42eb40f897a980f3852d51	no	6
Warnings:					
Information:					
8	Non Patent Literature	0007_2_npl_4820003us2_aarn_011719_f.pdf	177621 7dce4a72bf514b7875612ee25989d8410c78a6cb	no	14
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_4820004us1_oarn_12122018_f.pdf	1799080 16da58cb37ab75b961952e1f4865dfc0e4035c36	no	46
Warnings:					
Information:					
10	Non Patent Literature	0009_2_npl_4820_001us9_aarn_120318_f.pdf	950258 375f14e1c530af4613f51fb0f58350ddf8c2a6ef	no	37
Warnings:					
Information:					
11	Fee Worksheet (SB06)	fee-info.pdf	30655 079d33967cd69092a2fc78bf93aa32b6d938d9b2	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	8703492

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.:	4820.007US4	Serial No.:	15/978,760
Filed:	May 14, 2018	Due Date:	N/A
Examiner:	Amber Orlando	Group Art Unit:	1776
Customer No.:	21186	Confirmation No.:	6432

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)(1)** (2 pgs.), Form 1449 (1 pg.) Copies of Cited References (1).
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 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).

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.:	15/978,760	Group Art Unit:	1776
Filed:	May 14, 2018	Docket:	4820.007US4
Customer No.:	21186	Confirmation No.:	6432
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
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.: 15/978,760	Group Art Unit: 1776
Filed: May 14, 2018	Docket: 4820.007US4
Customer No.: 21186	Confirmation No.: 6432
Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY	

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R §1.97(e)(1)

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)(1), Applicant states 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.

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
NPL:jj Reg. No. 63,803

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 15/978,760	Filing Date 05/14/2018	☐ 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), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $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	03/20/2019	(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))	* 30	Minus	** 20	= 10		x $100 =	1000
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 3	= 1		x $460 =	460
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	1460

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".	/ANITA JOHNSON/
*** 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.

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 03/22/2019

GARIAS SALE #00000006 Mailroom Dt: 03/20/2019 190743 15978760

01	FC : 1817	4,000.00	DA
02	FC : 1830	140.00	DA

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL		
	Application Number	15/978,760
	Filing Date	May 14, 2018
	First Named Inventor	Edwin S. Olson
	Confirmation Number	6432
	Group Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.007US4
	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 (89 pages) is enclosed.
   - X Information Disclosure Statement (2 pages), Form 1449 (2 pages), and copies of cited documents (18).
   - X DECLARATION UNDER 37 C.F.R. § 1.132 (A) (11 pgs), (B) (12 pgs), (C) (16 pgs), and (D) (6 pgs)
   - X Power of Attorney (1 pg), Statement Under 37 CFR 3.73(c) (2 pgs), and Copy of Assignment (15 pgs)
   - X Certification and Request for Prioritized Examination Under 37 CFR 1.102(e) (1 pg)

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 $1460.00 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	**30**	-	**20**	**10**	**x 100.00 =**	**1000.00**
INDEPENDENT CLAIMS	**4**	-	**3**	**1**	**x 460.00 =**	**460.00**
[] MULTIPLE DEPENDENT CLAIMS PRESENTED						**0.00**
TOTAL						**1460.00**

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