

			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 sulfur dioxide	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 14:23
S175	75	"7435286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/15 15:07
S176	6	"9468886"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:48
S177	17	"8821819"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:51
S178	15	"8652235"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/16 06:55
S179	93	"6136749"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/24 09:08
S180	4	"9757689"	US-PGPUB; USPAT	ADJ	ON	2018/10/24 12:37
S181	9	"8939388"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 09:59
S182	669	urea with inject\$4 with filter\$4 with exhaust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/10/29 10:15

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

S195	3	anionic couterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S196	3480	anionic counterion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S197	2422	anionic counterion and ammonium with salt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S198	9	anionic counterion and ammonium with salt and remov\$4 with mercury	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:32
S199	52	"6960329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/03 14:50
S200	4	"20040003716"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2018/12/06 11:23
S201	1	"45219176".FMID.	US-PGPUB; USPAT; FPRS	ADJ	ON	2018/12/06 13:32
S202	0	pyrolysis with char with activated carbon with mercury with sorbent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	ADJ	ON	2019/01/07 09:41

1/ 7/ 2019 2:51:27 PM
C:\ Users\ amillerharris\ Documents\ EAST\ Workspaces\ 12429058.wsp

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)	<i>Complete if Known</i>	
	Application Number	15/974,343
	Filing Date	May 8, 2018
	First Named Inventor	Edwin S. Olson
	Group Art Unit	1776
	Examiner Name	Amber Orlando
Sheet 1 of 1		Attorney Docket No: 4820.001US9

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

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

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS				
Examiner Initial *	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.			T 1
	"Application Serial No. 14/712,558, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-19-18", 28 pgs			
	"Application Serial No. 14/712,558, Final Office Action mailed 01-11-19", 27 pgs			
	"Application Serial No. 15/382,114, Non Final Office Action mailed 12-12-18", 46 pgs			
	"Application Serial No. 15/589,359, Amendment and Response filed 01-17-19 to Non Final Office Action mailed 10-22-18", 14 pgs			
	"Application Serial No. 15/978,760, Amendment and Response filed 12-03-18 to Non Final Office Action mailed 10-10-18", 25 pgs			
	"Application Serial No. 15/978,760, Final Office Action mailed 12-26-18", 21 pgs			
	"Application Serial No. 15/997,091, Final Office Action mailed 01-11-19", 20 pgs			
	"Application Serial No. 15/997,091, Response filed 12-03-18 to Non Final Office Action mailed 11-02-18", 40 pgs.			

EXAMINER

DATE CONSIDERED

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

Electronic Patent Application Fee Transmittal

Application Number:	15974343			
Filing Date:	08-May-2018			
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY			
First Named Inventor/Applicant Name:	Edwin S. Olson			
Filer:	David L. Buck/Jamie Johnson			
Attorney Docket Number:	4820.001US9			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
Total in USD (\$)				240

Electronic Acknowledgement Receipt

EFS ID:	35253743
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	David L. Buck/Jamie Johnson
Filer Authorized By:	David L. Buck
Attorney Docket Number:	4820.001US9
Receipt Date:	26-FEB-2019
Filing Date:	08-MAY-2018
Time Stamp:	14:14:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 240
RAM confirmation Number	022719INTEFSW00000473190743
Deposit Account	
Authorized User	

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

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		15974343_SIDS_02-26-2019.pdf	265353	yes	5
			490d7146837220f4e832c7e31db0c0f3db3b9065		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Miscellaneous Incoming Letter		1	1	
	Miscellaneous Incoming Letter		2	2	
	Transmittal Letter		3	4	
	Information Disclosure Statement (IDS) Form (SB08)		5	5	
Warnings:					
Information:					
2	Non Patent Literature	0001_2_npl_4820001u10_foar_01112019_f.pdf	891808	no	20
			ee9f93bba7b182a0b361e8e8bbf4876dca68d873		
Warnings:					
Information:					
3	Non Patent Literature	0002_2_npl_4820001u10_response_f.pdf	915746	no	40
			95f4c32ca7327d46d8b5c307b1a7b72001c74600		
Warnings:					
Information:					
4	Non Patent Literature	0003_2_npl_4820001us7_aarn_120318_f.pdf	645370	no	28
			bbdb250afc40b03034dc8eef37a67110dd80ec32		
Warnings:					
Information:					

5	Non Patent Literature	0004_2_npl_4820001us7_foar_01112019_f.pdf	1277410	no	27
			fca3bd30b1f05fbc88deb5b1bba54aa4efb3261e		
Warnings:					
Information:					
6	Non Patent Literature	0005_2_npl_4820003us2_aarn_011719_f.pdf	177621	no	14
			2432999443c37999c81d89bac307749e3c821db3		
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_4820004us1_oarn_12122018_f.pdf	1799080	no	46
			97a34b05a884e8ef5517dd7e1fca9e7508113d8		
Warnings:					
Information:					
8	Non Patent Literature	0007_2_npl_4820007us4_foar_12262018_f.pdf	1010863	no	21
			7c986114a2bdb79239ffb00d1c029aec56e71a67		
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_4820_007us4_aarn_120318_f.pdf	637752	no	25
			8396e7d3f170b5e1769183ca6a1601dc301b488f		
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	30746	no	2
			c265bcd46fa7d5b24ad92a773a1e39a21dfc2ee		
Warnings:					
Information:					
Total Files Size (in bytes):			7651749		

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Docket No.: 4820.001US9
Filed: May 8, 2018
Examiner: Amber Orlando
Customer No.: 21186

Serial No.: 15/974,343
Due Date: N/A
Group Art Unit: 1776
Confirmation No.: 1072

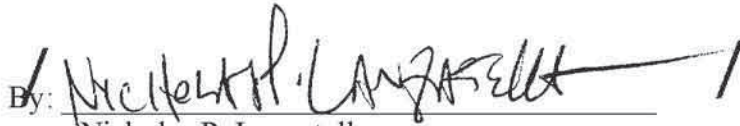
Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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

- ☒ Communication Concerning Prior and Copending Applications (1 pg.)
- ☒ 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).
- ☒ 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
Reg. No. 63,803

S/N 15/974,343

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

COMMUNICATION CONCERNING PRIOR OR COPENDING APPLICATION(S)

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

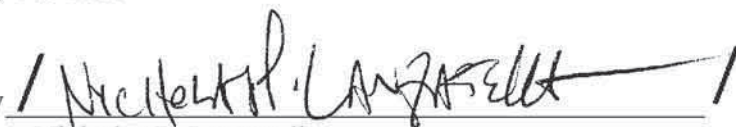
Pursuant to the guidance of MPEP §§ 2001.06(b) and 2004(9), Applicant would like to bring the following additional application(s) to the Examiner's attention. The identification of these applications is not intended to suggest that the subject matter claimed in any listed application is, or has been, substantially similar to any claim or claims in the present application.

<u>Serial No./</u> <u>Patent No.</u>	<u>Filing Date</u>	<u>Attorney Docket</u>	<u>Title</u>
15/997,091	June 4, 2018	4820.001U10	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
16/130,670	September 13, 2018	4820.005US2	SORBENT COMPRISING CARBON AND NITROGEN AND METHODS OF USING THE SAME

Respectfully submitted,

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

Date 02/26/2019

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

Examiner: Amber Orlando

Serial No.: 15/974,343

Group Art Unit: 1776

Filed: May 8, 2018

Docket: 4820.001US9

Customer No.: 21186

Confirmation No.: 1072

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R §1.97(e)(2)

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

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

Pursuant to 37 C.F.R. § 1.97(d)(1) and 37 C.F.R. § 1.97(e)(2), Applicant states that no item of information contained in the Supplemental Information Disclosure Statement was cited in any communication from a foreign patent office in a counterpart foreign application and that no item of information contained in the Supplemental Information Disclosure Statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

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

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

UNDER 37 C.F.R §1.97(e)(2)

Serial Number:15/974,343

Filing Date: May 8, 2018

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

Page 2

Dkt: 4820.001US9

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

Reg. No. 63,803

NPL:jj

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	15974343
	Filing Date	2018-05-08
	First Named Inventor	Edwin S. Olson
	Art Unit	1776
	Examiner Name	Amber Orlando
	Attorney Docket Number	4820.001US9

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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					

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

Add

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

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

Add

NON-PATENT LITERATURE DOCUMENTS			Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

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

1	"Application Serial No. 15 589,359, Response filed 04-30-19 to Final Office Action mailed 03-01-19", 11 pgs.
2	"Application Serial No. 15 589,359, Final Office Action mailed 03-01-19", 10 pgs
3	"Control of Mercury Emissions from Coal Fired Electric Utility Boilers: An Update", US EPA Air Pollution Prevention and Control Division, National Risk Management Research Laboratory, Office of Research and Development, (February 18, 2005), 59 pgs
4	"Sorbent Enhancement Additives for Mercury Control", US DOE Office of Fossil Energy, National Energy Technology Laboratory, (June 2008), 4 pgs
5	"Application Serial No. 15 978,760, Ex Parte Quayle Action mailed 04-19-19", 13 pgs
6	"Application Serial No. 15 295,594, Response filed 4-23-19 to Non Final Office Action mailed 10-23-18", 45 pgs
7	"Application Serial No. 15 978,760, Response filed 4-23-19 to Ex Parte Quayle Action mailed 04-19-19", 15 pgs
8	"Application Serial No. 15 978,760, Notice of Allowance mailed 05-08-19", 7 pgs
9	"Coal Combustion Products (CCPs): Characteristics, Utilization and Beneficiation", Edited by Tom Robl, et al., Woodhead Publishing (Elsevier), (2017), 565 pgs
10	"Application Serial No. 15 589,359, Advisory Action mailed 05-22-19", 3 pgs
11	"Application Serial No. 15 382,114, Response filed 3-12-19 to Non Final Office Action mailed 12-12-18", 24 pgs

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

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

12	"Application Serial No. 15 978,760, Response filed 03-20-19 to Final Office Action mailed 12-26-18", 90 pgs.
13	BENSON, STEVEN A., "JV Task 73 - Mercury Control Technologies for Electric Utilities Burning Subbituminous Coals - Draft Final Report", University of North Dakota Energy and Environmental Research Center, (June 2005), 165 pgs
14	BENSON, STEVEN A., "Pilot-and Full-Scale Demonstration of Advanced Mercury Control Technologies for Lignite-Fired Power Plants", University of North Dakota Energy and Environmental Research Center, (February 2005), 97 pgs
15	BERRY, MARK, "Mercury control evaluation of calcium bromide injection into a PRB-fired furnace with an SCR", Proc. of the Air Quality VI Conference, Arlington, VA, (2007), 9 pgs
16	BROWN, THOMAS D., "Mercury Measurement and Its Control: What We Know, Have Learned, and Need to Further Investigate", Journal of the Air and Waste Management Association, 49(6), (June 1999), 98 pgs
17	FEELEY, THOMAS J., "A Review of DOE NETL's Mercury Control Technology R and D Program for Coal-Fired Power Plants", DOE NETL Hg R and D Program Review, (April 2003), 32 pgs
18	FRENCH, CHARLES L., "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units - Final Report to Congress: Volume 1", US EPA Office of Air Quality Planning and Standards, (February 1998), 502 pgs
19	GHORISHI, BEHROOZ S., "In-Flight Capture of Elemental Mercury by Chlorine-Impregnated Activated Carbon", Proc. of the 94th Annual Meeting of the Air and Waste Management Association, Orlando, FL, (June 2001), 14 pgs
20	JONES, ANDREW P., "DOE NETL's Phase II Mercury Control Technology Field Testing Program: Preliminary Economic Analysis of Activated Carbon Injection", Environmental Science and Technology, 41(4), (2007), 7 pgs
21	KEATING, MARTHA H., "Mercury Study Report to Congress Volume 1: Executive Summary", US EPA Office of Air Quality Planning and Standards, (December 1997), 95 pgs
22	KILGROE, JAMES D., "Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report", US EPA Office of Research and Development, National Risk Management Laboratory, Air Pollution Prevention and Control Division, (December 2001), 485 pgs

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

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

23	NELSON, SID JR., "How China Can Leapfrog the World in Mercury Emission Reductions", Proc. of the AWMA Intl. Specialty Conference on Leapfrogging Opportunities for Air Quality Improvement, (2010), 24 pgs
24	PAVLISH, JOHN H., "Status review of mercury control options for coal-fired power plants", Fuel Processing Technology, Vol. 82, (2003), 77 pgs
25	YANG, YANG, "Effect of HBr formation on mercury oxidation via CaBr(2) addition to coal during combustion", RSC Advances, 6(64), (2016), 7 pgs

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

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

CERTIFICATION STATEMENT

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

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

OR

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

See attached certification statement.

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

A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Nicholas P. Lanzatella/	Date (YYYY-MM-DD)	2019-05-23
Name/Print	Nicholas P. Lanzatella	Registration Number	63,803

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

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

Electronic Patent Application Fee Transmittal

Application Number:	15974343			
Filing Date:	08-May-2018			
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY			
First Named Inventor/Applicant Name:	Edwin S. Olson			
Filer:	David L. Buck/Jamie Johnson			
Attorney Docket Number:	4820.001US9			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
Total in USD (\$)				240

Electronic Acknowledgement Receipt

EFS ID:	36099231
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	David L. Buck/Jamie Johnson
Filer Authorized By:	David L. Buck
Attorney Docket Number:	4820.001US9
Receipt Date:	23-MAY-2019
Filing Date:	08-MAY-2018
Time Stamp:	15:04:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 240
RAM confirmation Number	052419INTEFSW00001486190743
Deposit Account	
Authorized User	

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

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	15974343_ids_05-23-2019.pdf	641809	no	6
			8af1cfcb99bf9512d13038fc02b631a1111f0e63		
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Non Patent Literature	0001_2_npl_15295594_aarn_42319_f.pdf	4161904	no	45
			1eca0c01316f122f8386eadeb482628b734c6f9b		
Warnings:					
Information:					
3	Non Patent Literature	0002_2_npl_15382114_aarn_31219_f.pdf	203950	no	24
			0a95808d857931cd931c87e7bf3d7722fd0bc15b		
Warnings:					
Information:					
4	Non Patent Literature	0003_2_npl_4820003us2_aarf_043019_f.pdf	165014	no	11
			497e0c1081d6819122e412ab8d5931e1a0c6cc34		
Warnings:					
Information:					
5	Non Patent Literature	0004_2_npl_4820003us2_adar_05222019_f.pdf	161044	no	3
			01c1fdd20373ecce2d1cc45ae08c4787bf8e17c1		
Warnings:					
Information:					

6	Non Patent Literature	0005_2_npl_4820003us2_foar_03012019_f.pdf	438392	no	10
			81358c9f5ede047776cbfce94fbb87427d2640eb		
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_4820007us4_epqa_04192019_f.pdf	436348	no	13
			d80e0d6d6880cfdfe36d4ac76b9346114582e430		
Warnings:					
Information:					
8	Non Patent Literature	0007_2_npl_4820007us4_noar_05082019_f.pdf	398773	no	7
			3d0eb07622b022e2bbc4cdca92ec30ce02c511ed		
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_4820_007us3_nfoaresp_f.pdf	4162347	no	45
			b19cc001453872b816ce141e8d397f2c4e0f225f		
Warnings:					
Information:					
10	Non Patent Literature	0009_2_npl_4820_007us4_aarf_032019_f.pdf	5023144	no	90
			44cdb0afb4d2740ac7d8d08fdb7bbd9cae6eb1a0		
Warnings:					
Information:					
11	Non Patent Literature	0010_2_npl_benson_mercury_trol_tech_2005_f.pdf	2551334	no	97
			64a3eea775cfd0b893a85cb55a75874aa6ee69b6		
Warnings:					
Information:					
12	Non Patent Literature	0011_2_npl_benson_subbituminous_coals_2005_f.pdf	4821773	no	165
			fd4ac7842a154eca6f187385eb1bfea6d5274e77		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					

13	Non Patent Literature	0012_2_npl_berry_mercury_trol_2007_f.pdf	195610	no	9
			bc5f5b58c53c0ffdd84b520fa57373fa38e6c53c		
Warnings:					
Information:					
14	Non Patent Literature	0013_2_npl_brown_mercury_measurement_2011_f.pdf	1949189	no	98
			e2c69a3b171d5136d87bf89d5808b5e3d5de60774		
Warnings:					
Information:					
15	Non Patent Literature	0014_2_npl_coalcombustionproducts_elsevier_2017_f.pdf	9826299	no	565
			d5f9d991249ee3d5e4cab2ec4daff0c8a53de403		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
16	Non Patent Literature	0015_2_npl_doe_seas_for_mercury_trol_2008_f.pdf	178022	no	4
			5ab0021d1e8a38d97cd7b4e301e10b3ad3bc7564		
Warnings:					
Information:					
17	Non Patent Literature	0016_2_npl_epa_mercury_emissions_update_2005_f.pdf	599904	no	59
			1fadedd8581ba61ce180ab727f6607a6bffaad7d		
Warnings:					
Information:					
18	Non Patent Literature	0017_2_npl_feeley_doe_netl_mercury_2003_f.pdf	476773	no	32
			9dfb3d6b2717b62f796d64a8199c63d232ec59d4		
Warnings:					
Information:					
19	Non Patent Literature	0018_2_npl_french_epa_utility_report_1998_f.pdf	4362131	no	502
			8273d80a2922f60d14deb945d1a51da7a980a038		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the					

Image File Wrapper and may affect subsequent processing

Information:					
20	Non Patent Literature	0019_2_npl_ghorishi_inflight_2001_f.pdf	189025	no	14
			016a8bdeb94fc316b16b681528cceec5eca695ce		
Warnings:					
Information:					
21	Non Patent Literature	0020_2_npl_jones_doe_netl_phase2_hg_2007_f.pdf	220901	no	7
			ccf0c322a6299d4831b2917ef0824dd03f09913e		
Warnings:					
Information:					
22	Non Patent Literature	0021_2_npl_keating_epa_mercury_study_1997_f.pdf	943771	no	95
			806d6eb72efc7c26e7ccba973612491d5659ea6e		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
23	Non Patent Literature	0022_2_npl_kilgrove_epa_mercury_interim_report_2002_f.pdf	6484898	no	485
			0537dff50eba1eabceaacb80aaf7a39845484fb5e		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
24	Non Patent Literature	0023_2_npl_nelson_china_emissions_2010_f.pdf	2799675	no	24
			b3956939e57cbcee73f76d51992ebbcac0620081		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
25	Non Patent Literature	0024_2_npl_pavlish_status_review_2003_f.pdf	907898	no	77
			8a4236587218af8687ed4e36fbf854d2095eb0cf		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					

Exhibit 204

Information:					
26	Non Patent Literature	0025_2_npl_yang_hbr_hg_oxidation_2016_f.pdf	625919 1117fb6a7e90c33926cd18ee0f71ec6ecf0a8f14	no	7
Warnings:					
Information:					
27	Fee Worksheet (SB06)	fee-info.pdf	30746 2900cb3a15d98cf173d866c6b2f825377795f5ed	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			52956593		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <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.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 15/974,343		Filing Date 05/08/2018		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A						
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A	N/A						
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A						
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *		x \$100 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *		x \$460 =						
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL						
APPLICATION AS AMENDED - PART II										
		(Column 1)	(Column 2)	(Column 3)						
AMENDMENT	05/15/2018	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 16	Minus ** 20	= 0	x \$100 =		0			
	Independent (37 CFR 1.16(h))	* 1	Minus *** 3	= 0	x \$460 =		0			
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		0			
AMENDMENT	07/10/2019	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 29	Minus ** 23	= 6	x \$100 =		600			
	Independent (37 CFR 1.16(h))	* 3	Minus *** 3	= 0	x \$460 =		0			
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		600			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.					LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".					/LAN M DONG/					
*** 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: 07/16/2019

LDONG1	SALE	#00000001	Mailroom Dt:	07/10/2019	190743	15974343
		01	FC : 1202	600.00	DA	

**REQUEST
FOR
CONTINUED EXAMINATION (RCE)
TRANSMITTAL**

<i>Application Number</i>	15/974,343
<i>Filing Date</i>	May 8, 2018
<i>First Named Inventor</i>	Edwin S. Olson
<i>Confirmation Number</i>	1072
<i>Group Art Unit</i>	1776
<i>Examiner Name</i>	Amber Orlando
<i>Attorney Docket Number</i>	4820.001US9
<i>Customer No.</i>	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:

- ☒ Amendment and Response Under 37 C.F.R. § 1.116 (81 pages) is enclosed.
- ☒ Certification and Request for Prioritized Examination (Track 1) (1 pg)
- ☒ Information Disclosure Statement (2 pages), Form 1449 (1 page), and copies of cited documents (4).
- ☒ Petition for Extension of Time (1 pg).
- ☒ DECLARATION UNDER 37 C.F.R. § 1.132 (A) (11 pgs), (B) (12 pgs), (C) (16 pgs), and (D) (6 pgs)

2. Fees

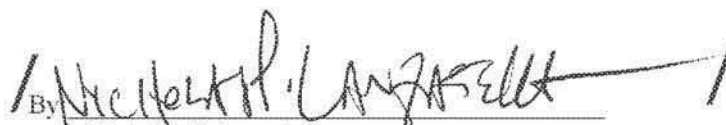
- ☒ Authorization to charge deposit account 19-0743 in the amount of \$1300.00 to pay the RCE filing fee required under 37 C.F.R. § 1.17(e).
- ☒ Authorization to charge Deposit Account 19-0743 in the amount of \$4000.00 for the Prioritized Examination (Track 1) filing fee as set forth in 37 C.F.R. § 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.
- ☒ Authorization to charge deposit account 19-0743 in the amount of \$1400.00 to pay the extension of time fee.
- ☒ Authorization to charge deposit account 19-0743 in the amount of \$300.00 to cover the fee for additional claims.

The fee for additional claims has been calculated as follows:

CLAIMS AS AMENDED						
	Claims Remaining After Amendment		Highest Number Previously Paid For	Present Extra	Rate	Fee
TOTAL CLAIMS	29	-	26	<u>3</u>	x 100.00 =	300.00
INDEPENDENT CLAIMS	0	-	3	<u>0</u>	x 460.00 =	0.00
 MULTIPLE DEPENDENT CLAIMS PRESENTED						0.00
TOTAL						300.00

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

SCHWEGMAN LUNDBERG & WOESSNER, P.A.

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

Electronic Patent Application Fee Transmittal

Application Number:	15974343			
Filing Date:	08-May-2018			
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY			
First Named Inventor/Applicant Name:	Edwin S. Olson			
Filer:	Janal M. Kalis/Megan Reed			
Attorney Docket Number:	4820.001US9			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	3	100	300
Miscellaneous-Filing:				
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with \$0 paid	1253	1	1400	1400
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1300	1300
Total in USD (\$)				7140

Electronic Acknowledgement Receipt

EFS ID:	36548280
Application Number:	15974343
International Application Number:	
Confirmation Number:	1072
Title of Invention:	SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY
First Named Inventor/Applicant Name:	Edwin S. Olson
Customer Number:	21186
Filer:	Janal M. Kalis/Megan Reed
Filer Authorized By:	Janal M. Kalis
Attorney Docket Number:	4820.001US9
Receipt Date:	10-JUL-2019
Filing Date:	08-MAY-2018
Time Stamp:	17:21:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$7140
RAM confirmation Number	071119INTEFSW00004415190743
Deposit Account	190743
Authorized User	Megan Reed

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

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

37 CFR 1.17 (Patent application and reexamination processing fees)

Exhibit 2044

Page 440

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIGNED_4820_001US9_RCE_Resp_IDS_Track1_Ext_Dec2.pdf	6934940 bf53d274898945dd1cc054c074a73dccc2f3015d5	yes	132
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Affidavit-traversing rejectns or objectns rule 132		127	132	
	Affidavit-traversing rejectns or objectns rule 132		111	126	
	Affidavit-traversing rejectns or objectns rule 132		99	110	
	Affidavit-traversing rejectns or objectns rule 132		88	98	
	Extension of Time		87	87	
	Information Disclosure Statement (IDS) Form (SB08)		86	86	
	Transmittal Letter		84	85	
	TrackOne Request		83	83	
	Applicant Arguments/Remarks Made in an Amendment		8	82	
	Claims		3	7	
	Amendment Submitted/Entered with Filing of CPA/RCE		2	2	
	Request for Continued Examination (RCE)		1	1	
Warnings:					
Information:					
2	Non Patent Literature	4820003US2_OARN_06212019.pdf	725411 bd02af29f6306336834867dff822a1685fe6a782	no	7

Exhibit 2044

Warnings:					
Information:					
3	Non Patent Literature	4820004US1_FOAR_06212019.pdf	3420798 ce5f3b2af5af470b21fbbe0f2a7f662db53c2c0f	no	31
Warnings:					
Information:					
4	Non Patent Literature	4820007US4_NALL_05302019.pdf	405171 69a3d81f98e358e2bb1500dcae1b5b04c1fca0ec	no	3
Warnings:					
Information:					
5	Foreign Reference	WO_2012030560_A1.pdf	2254578 e6ec792da1cb5fa7c2bfa0e135da52594f23efc	no	19
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	39166 3790e29e72718d3843fd0252374384cb478c1d9	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			13780064		
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.					

A/N 15/978,760

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

Examiner: AMBER ROSE ORLANDO

Application No.: 15/978,760

Group Art Unit: 1776

Filed: May 14, 2018

Docket No.: 4820.007US4

Confirmation No.: 6432

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

DECLARATION D

I, John Pavlish, declare and say as follows:

1. I have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competitiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and

technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

2. Declaration B at item 8 describes that a pilot-scale 550,000-Btu/hr pulverized coal (pc)-fired test unit was used to combust subbituminous coal and test mercury control using various sorbents. The coal combustion flue gas exiting the pilot unit was cooled down to a nominal temperature of 149°C (300°F) and then was introduced into a single wire tubular ESP unit. Activated carbon sorbents were fed with a K-Tron dual-screw feeder upstream of the ESP. The feeder was calibrated prior to the start of each carbon injection test. No scrubber was used. Before Hg control testing began, a baseline condition was established with the pilot-scale unit, and flue gas mercury content was measured before each test as about 6-10 µg/m³. The flue gas HCl concentration, with no additives on the coal, as calculated by the chlorine measured in the coal, was 2-5 ppm.

3. U.S. patent publication no. 2004/0003716 ("Nelson") describes treatment of activated carbon outside the flue gas with hydrogen bromide (HBr), and describes testing to measure the percent mercury removal when the treated activated carbon was injected into either simulated or actual flue gas at various injection rates. Specifically, Nelson performed experiments in Example 5 (paragraphs [0082]-[0085]) and 7 (paragraphs [0089]-[0092]), and provides the data in FIG. 14 and FIG. 15.

4. In Example 5, Nelson treated Norit DARCO® FGD with gaseous HBr, and tested its use by injecting the HBr-treated sorbent into a simulated coal-fired flue-gas stream in a pilot-scale test system. Nelson's FIG. 14 shows data for one activated carbon sample treated with HBr. The activated carbon had 10 wt% HBr, and at a sorbent injection rate of about 3.7 lb/MMacf gave a mercury removal of about 82%. As reported in paragraph [0082] of Nelson, duct-injection runs were performed with a simulated coal-fired flue-gas

stream on a 50-acfm pilot-scale test system. As described, the mercury mass transfer to fluidized sorbent and adsorption kinetics in this system were similar to that in a full-scale utility application. The fully-instrumented duct-injection test system that was used included a propane burner unit to generate the hot flue gas; a humidification drum to add an appropriate degree of moisture to the gas; an elemental mercury spiking subsystem with elemental mercury permeation tubes; a flue gas spiking subsystem with mass flow controllers for SO_2 , NO_x , and HCl ; a small sorbent feeder and fluidizing injection subsystem to lessen sorbent pulsing; 10 meters of insulated, 10-cm-diameter ducting circling the ceiling; thermocouples; an electrostatic filter with an effective specific collection area (SCA) of about $500 \text{ ft}^2/\text{Kacf}$; a back-up fabric filter; a safety filter; an orifice plate to measure flow; and a variable-speed I.D. fan. The gas temperature at injection was about 175°C and at the electrostatic precipitator (ESP) was about 145°C and the spiked flue gas concentrations were about $24 \mu\text{g}/\text{Nm}^3 \text{ Hg}(0)$, 1400 ppm SO_2 , 600 ppm NO_x , and 5 ppm HCl , typical values for coal-fired power plants.

5. In Example 7, Nelson treated Norit DARCO® FGD with gaseous HBr , and tested its use in a coal-fired power plant by injecting the treated sorbent into the flue gas prior to the electrostatic precipitator (ESP). Nelson's FIG. 15 shows data for two activated carbon samples treated with HBr . The two activated carbon samples contained 9 wt% HBr . The data in FIG. 15 for the two HBr -treated sorbents show that at a sorbent injection rate of about $2.2 \text{ lb}/\text{MMacf}$, 45% of the mercury was removed, and at a sobent injection rate of about $4.2 \text{ lb}/\text{MMacf}$, 62% of the mercury was removed. As reported in paragraphs [0089]-[0091] of Nelson, a large-scale duct-injection trial was performed at the 18-MW scale, with about 60,000 acfm of flue gas at 160°C (320°F). The plant had stoker-fed boilers, burned a high-sulfur bituminous coal, and had just a cold-side ESP for emission control. Baseline sampling according to the Ontario Hydro Method indicated no intrinsic mercury removal of mercury across the ESP. Without sorbent injection, the plant emitted about $10 \mu\text{g}/\text{Nm}^3$ of mercury from the stack, with 80 to 90% of this in oxidized forms. In these trials, the mercury was measured using a speciating PS Analytical Sir Galahad continuous mercury monitor. Inlet mercury values were obtained

by sampling upstream of the sorbent injection point and outlet mercury was measured at the stack. The sorbents were injected into ductwork through a lance to mix with the flue gases about 40 feet from the entrance to the ESP. The flue gas contained about 1000 ppm of SO₂, 20 ppm of SO₃, 250 ppm of NO_x, and 25 ppm of HCl. The ESP had an SCA of 370 ft²/Kacfm.

6. Nelson's Examples 5 and 7 do not describe the use of a scrubber. Example 7 of Nelson uses only a cold-side ESP for emission control, with injection of the activated carbon upstream of the ESP. Example 5 of Nelson describes an ESP that occurs after the point of injection and that has a temperature of 145 °C (293 °F) at the inlet, also corresponding to a cold-side ESP. Similarly, in the pilot-scale setup described at item 8 of Declaration B no scrubber was used, and activated carbon was injected upstream of the ESP. These similarities between Nelson's Example 5 and 7 and the pilot-scale setup described at item 8 of Declaration B allow for good comparison with the Nelson data.

7. Nelson's Example 5 describes a flue gas HCl concentration of 5 ppm, which is similar to the flue gas HCl concentration in the pilot-scale setup described at item 8 of Declaration B, allowing for good comparison between Nelson's Example 5 and the pilot-scale setup described at item 8 of Declaration B. However, Nelson's Example 7 describes a flue gas HCl concentration of 25 ppm. The higher HCl concentration in Nelson's Example 7 flue gas allows for easier mercury removal, due to HCl acting as a promotor of the activated carbon, as compared to the pilot-scale setup described at item 8 of Declaration B.

8. The mercury concentration of the flue gas from the pilot-scale setup described at item 8 of Declaration B was in the range of 6-10 µg/m³, as compared to Nelson's Example 5 data for which the mercury concentration of the flue gas is about 24 µg/m³. The higher mercury concentration in Nelson's Example 5 allows for easier mercury removal as the mercury concentration at the point of activated carbon injection is much higher. To illustrate this, to remove 70% of the mercury from Nelson's Example 5 setup,

the mercury concentration leaving the ESP after the mercury is captured by the treated activated carbon would be: $24 - (24 * 70 / 100) = 7.2 \mu\text{g}/\text{m}^3$. To remove 70% of the mercury from the pilot-scale setup described at item 8 of Declaration B, the mercury concentration leaving the ESP after the mercury is captured by the activated carbon would be: $8 - (8 * 70 / 100) = 2.4 \mu\text{g}/\text{m}^3$. When mercury concentration is lower, the probability of activated carbon sorbent particles contacting mercury in the flue gas is lower, and the overall number of encounters between activated carbon particles and mercury atoms or compounds per time is lower; therefore, the activated carbon sorbent particles must be more adsorptive (e.g., reactive) toward mercury in order to remove mercury at low concentrations as compared to the same activated carbon sorbent placed in a higher concentration of mercury. As the calculation shows, it is more difficult to remove the same percentage of mercury from the flue gas starting with a lower concentration of $8 \mu\text{g}/\text{m}^3$ than starting at a higher concentration of $24 \mu\text{g}/\text{m}^3$.

9. As explained at item 6, Nelson's experimental setup in Examples 5 and 7 and the experimental setup described at item 8 of Declaration B inject activated carbon sorbent into a flue gas upstream of an ESP and use no scrubber, making the procedures comparable. However, as explained at item 7, the higher HCl concentration in Nelson's Example 7 flue gas allows for easier mercury removal, due to HCl acting as a promotor of the activated carbon, as compared to the pilot-scale setup described at item 8 of Declaration B. Further, as explained at item 8, the higher mercury concentration in Nelson's Example 5 makes it easier for Nelson's sorbents to remove the same overall percentage of mercury from the flue gas, as compared to the pilot-scale setup described at item 8 of Declaration B. Therefore, if Nelson's Example 5 and 7 HCl and mercury concentrations were changed to match those of the pilot-scale setup described at item 8 of Declaration B, Nelson's sorbents would remove a lower percentage of mercury than found in Nelson's Examples 5 and 7.

10. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by a fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and/or any patent issued thereon.

Dated: March 20, 2019

By: / John Pavlish /

John Pavlish

A/N 15/978,760

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

Examiner: AMBER ROSE ORLANDO

Application No.: 15/978,760

Group Art Unit: 1776

Filed: May 14, 2018

Docket No.: 4820.007US4

Confirmation No.: 6432

Title: SORBENTS FOR THE OXIDATION AND REMOVAL OF MERCURY

DECLARATION UNDER 37 C.F.R. § 1.132

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

DECLARATION C

We, John Pavlish and Nicholas Lentz, declare and say as follows:

I, John Pavlish, have been the Chief Technology Officer and Senior Vice President of Midwest Energy Emissions Corporation since November 16, 2014. Prior to this, I served as an Executive Consultant Advisor to Midwest Energy Emissions Corporation. Prior to joining Midwest Energy Emissions Corporation, I was a Senior Research Advisor and the Director of the Center for Air Toxic Metals Program at the Energy & Environmental Research Center in Grand Forks, North Dakota. I have over 25 years of mercury-related experience and am regarded as an international expert on the topic of mercury. My primary areas of interest and expertise include research, technical consultation and development of mercury control technologies, in particular, for coal combustion and gasification systems. I am an inventor of a number of patented mercury control technologies and have years of experience in development and testing of these technologies for commercial applications. Over the last 15 years, I have spent much time evaluating the efficacy of a number of different mercury control technologies/approaches and their cost competitiveness in the commercial market. I also have years of power plant experience and have worked for an engineering/consulting company, Black & Veatch, where I served as Unit Leader/System Engineer. I am a professional engineer, a member of the American Society of Mechanical Engineers, and a member of the Air & Waste Management Association (A&WMA). I serve on numerous professional and

technical committees and am a U.S. Representative on the Mercury Emissions from Coal International Experts Working Group on Reducing Emissions from Coal and a member of the United Nations Environment Programme Global Mercury Partnership, Reduction of Mercury Releases from Coal Combustion. I have published over 200 papers, articles, and reports on various mercury-related topics and issues.

2. I, Dr. Nicholas Lentz, Field Technical Manager for Midwest Energy Emissions Corporation, have more than 10 years of experience conducting mercury research and tests, both in the lab and in the field with over 30 full-scale mercury test programs and also numerous bench- and pilot-test projects. I am also an expert in the identification and development of new analytical methods for the advancement of elemental and small molecule analysis in a wide range of matrices including coal and coal by-products, CO₂ capture solutions, oil and gas fuels; analysis for combustion flue gas, syngas, fuel oil, and biowaste. Prior to my current position, I was an Associate Director for Energy Technology Applications in the Institute for Energy Studies at the University of North Dakota. I also previously was a Center for Air Toxic Metals (CATM) Program Area Manager and Research Scientist at the Energy & Environmental Research Center where I was responsible for managing a portfolio of measurement-based research projects in the Analytical Measurement Area of CATM as well as experimental design and analysis related control technologies to remove mercury, trace metals, and halogens from combustion and gasification systems. I have a B.S. in Chemistry from Bemidji State University and Ph.D. in Analytical Chemistry from Iowa State University. I have authored and co-authored numerous publications.

3. All websites referenced in this document were accessed 3/15/2019.

4. Merriam-Webster dictionary defines “bromine” as “a nonmetallic halogen element that is isolated as a deep red corrosive toxic volatile liquid of disagreeable odor. See, <https://www.merriam-webster.com/dictionary/bromine>. Wikipedia defines “bromine” as “...a chemical element with symbol Br and atomic number 35. It is the

third-lightest halogen, and is a fuming red-brown liquid at room temperature that evaporates readily to form a similarly coloured gas.” See, <https://en.wikipedia.org/wiki/Bromine>. Dictionary.com defines “bromine” as “an element that is a dark-reddish, fuming, toxic liquid and a member of the halogen family: obtained from natural brines and ocean water, and used chiefly in the manufacture of gasoline antiknock compounds, pharmaceuticals, and dyes. Symbol: Br; atomic weight: 79.909; atomic number: 35 ...” See, <https://www.dictionary.com/browse/bromine>.

5. Merriam-Webster dictionary defines “chlorine” as “a halogen element that is isolated as a heavy greenish-yellow diatomic gas of pungent odor and is used especially as a bleach, oxidizing agent, and disinfectant in water purification.” See, <https://www.merriam-webster.com/dictionary/chlorine>. Wikipedia defines “chlorine” as “...a chemical element with symbol Cl and atomic number 17. The second-lightest of the halogens, it appears between fluorine and bromine in the periodic table and its properties are mostly intermediate between them. Chlorine is a yellow-green gas at room temperature.” See, <https://en.wikipedia.org/wiki/Chlorine>. Dictionary.com defines “chlorine” as “a halogen element, a heavy, greenish-yellow, incombustible, water-soluble, poisonous gas that is highly irritating to the respiratory organs, obtained chiefly by electrolysis of sodium chloride brine: used for water purification, in the making of bleaching powder, and in the manufacture both of chemicals that do not contain chlorine, as ethylene glycol, and of those that do. Symbol: Cl; atomic weight: 35.453; atomic number: 17.” See, <https://www.dictionary.com/browse/chlorine>.

6. Encyclopedia Britannica online states that “[a]t room temperature and atmospheric pressure the halogen elements in their free states exist as diatomic molecules.” <https://www.britannica.com/science/halogen-element>. The Chemistry LibreTexts Library states that “[h]alogens form diatomic molecules (of the form X₂, where X denotes a halogen atom) in their elemental states. The bonds in these diatomic molecules are non-polar covalent single bonds” See, [https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_\(I](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_(I)

norganic Chemistry)/Descriptive Chemistry/Elements Organized by Block/2 p-Block Elements/Group 17%3A The Halogens/0Group 17%3A Physical Properties of the Halogens/Group 17%3A General Properties of Halogens. ThoughtCo.com states that “[h]alogens range from solid (I₂) to liquid (Br₂) to gaseous (F₂ and Cl₂) at room temperature. As pure elements, they form diatomic molecules with atoms joined by nonpolar covalent bonds.” See, <https://www.thoughtco.com/halogen-elements-and-properties-606650>.

7. Sigma-Aldrich gives the properties of elemental bromine, Br₂ as including a molecular weight of 159.81 g/mol, a boiling point of 58.8 °C, and a melting point of -7.2 °C. See,

<https://www.sigmaaldrich.com/catalog/product/sigald/207888?lang=en®ion=US>.

8. Sigma-Aldrich gives the properties of Cl₂ as including a molecular weight of 70.91 g/mol, a boiling point of -34 °C, and a melting point of -101 °C. See,

<https://www.sigmaaldrich.com/catalog/product/aldrich/295132?lang=en®ion=US>.

9. Merriam-Webster dictionary defines “bromide” as “1: a binary compound of bromine with another element or a radical including some (such as potassium bromide) used as sedatives.” See, <https://www.merriam-webster.com/dictionary/bromide>.

Wikipedia defines “bromide” as “...a chemical compound containing a bromide ion or ligand. This is a bromine atom with an ionic charge of -1 (Br⁻); for example, in caesium bromide, caesium cations (Cs⁺) are electrically attracted to bromide anions (Br⁻) to form the electrically neutral ionic compound CsBr. The term “bromide” can also refer to a bromine atom with an oxidation number of -1 in covalent compounds such as sulfur dibromide (SBr₂).” See, <https://en.wikipedia.org/wiki/Bromide>. Dictionary.com defines “bromide” as “1. A salt of hydrobromic acid consisting of two elements, one of which is bromine, as sodium bromide, NaBr; 2. A compound containing bromine, as methyl bromide.” See, <https://www.dictionary.com/browse/bromide>.

10. Merriam-Webster dictionary defines “chloride” as “1: a compound of chlorine with another element or group especially: a salt or ester of hydrochloric acid; 2: a monovalent anion consisting of one atom of chlorine.” See, <https://www.merriam-webster.com/dictionary/chloride>. Wikipedia defines “chloride” as “...a compound of chlorine with a salt or ester of hydrochloric acid” and as “...the anion (negatively charged ion) Cl⁻.” See, [https://en.wikipedia.org/wiki/Chloride_\(disambiguation\)](https://en.wikipedia.org/wiki/Chloride_(disambiguation)) and <https://en.wikipedia.org/wiki/Chloride>. Dictionary.com defines “chloride” as “1. A salt of hydrochloric acid consisting of two elements, one of which is chlorine, as sodium chloride, NaCl; 2. A compound containing chlorine, as methyl chloride, CH₃Cl.” See, <https://www.dictionary.com/browse/chloride>.

11. Wikipedia defines “hydrogen halides” as “... diatomic inorganic compounds with the formula HX where X is one of the halogens: fluorine, chlorine, bromine, iodine, or astatine. ... Hydrogen halides are gases that dissolve in water to give acids which are commonly known as hydrohalic acids. The direct reaction of hydrogen with fluorine and chlorine gives hydrogen fluoride and hydrogen chloride, respectively. Industrially these gases are, however, produced by treatment of halide salts with sulfuric acid. Hydrogen bromide arises when hydrogen and bromine are combined at high temperatures in the presence of a platinum catalyst. The least stable hydrogen halide, HI, is produced less directly, by the reaction of iodine with hydrogen sulfide or with hydrazine.” See, https://en.wikipedia.org/wiki/Hydrogen_halide.

12. Merriam-Webster defines “hydrogen bromide” “a colorless irritating gas HBr that fumes in moist air and yields hydrobromic acid when dissolved in water.” See, <https://www.merriam-webster.com/dictionary/hydrogen%20bromide>. Dictionary.com defines “hydrogen bromide” as “a colorless gas, HBr, having a pungent odor: the anhydride of hydrobromic acid.” See, <https://www.dictionary.com/browse/hydrogen-bromide>. Wikipedia defines “hydrogen bromide” as “...the diatomic molecule with the formula HBr. It is a colorless compound and a hydrogen halide. Hydrobromic acid is a solution of HBr in water. Both the anhydrous and aqueous solutions of HBr are common

reagents in the preparation of bromide compounds. ...Hydrogen bromide (along with hydrobromic acid) is produced by combining hydrogen and bromine at temperatures between 200 and 400 °C. The reaction is typically catalyzed by platinum or asbestos.”

13. Merriam-Webster defines “hydrogen chloride” as “a colorless pungent poisonous gas HCl that fumes in moist air and yields hydrochloric acid when dissolved in water.”

See, <https://www.merriam-webster.com/dictionary/hydrogen%20chloride>.

Dictionary.com “hydrogen chloride” “a colorless gas, HCl, having a pungent odor: the anhydride of hydrochloric acid.” Wikipedia defines “hydrogen chloride” as “[t]he compound hydrogen chloride has the chemical formula HCl and as such is a hydrogen halide. At room temperature, it is a colorless gas, which forms white fumes of hydrochloric acid upon contact with atmospheric water vapor. Hydrogen chloride gas and hydrochloric acid are important in technology and industry. Hydrochloric acid, the aqueous solution of hydrogen chloride, is also commonly given the formula HCl. ...pure chlorine gas can be combined with hydrogen to produce hydrogen chloride in the presence of UV light: $\text{Cl}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow 2 \text{HCl}(\text{g})$.”

14. Sigma-Aldrich gives the properties of HBr as including a molecular weight of 80.91 g/mol, a boiling point of -67 °C, and a melting point of -87 °C. See, <https://www.sigmaaldrich.com/catalog/product/aldrich/295418?lang=en®ion=US>.

15. Sigma-Aldrich gives the properties of HCl as including a molecular weight of 36.46 g/mol, a boiling point of -85 °C, and melting point of -114 °C. See, <https://www.sigmaaldrich.com/catalog/product/aldrich/295426?lang=en®ion=US>.

16. Wikipedia defines the “octet rule” as “... a chemical rule of thumb that reflects observation that atoms of main-group elements tend to combine in such a way that each atom has eight electrons in its valence shell, giving it the same electron configuration as a noble gas. The rule is especially applicable to carbon, nitrogen, oxygen, and the

halogens, but also to metals such as sodium or magnesium.” See, https://en.wikipedia.org/wiki/Octet_rule.

17. As shown by items 3-16 herein, hydrogen halides are diatomic molecules including a halogen atom and a hydrogen atom; in contrast, elemental halogens are diatomic molecules including two of the same halogen atom. HBr and HCl each include a hydrogen atom and one halogen atom, while Br₂ and Cl₂ each include two halogen atoms. Hydrogen halides have different properties than elemental halogens and are therefore different compounds. HBr has a molecular weight of 80.91 g/mol, while Br₂ has a molecular weight of 159.81 g/mol; HBr has a boiling point of -67 °C, while Br₂ has a boiling point of 58.8 °C; HBr has a melting point of -87 °C, while Br₂ has a melting point of -7.2 °C. HCl has a molecular weight of 36.46 g/mol, while Cl₂ has a molecular weight of 70.91 g/mol; HCl has a boiling point of -85 °C, while Cl₂ has a boiling point of 70.91 g/mol; HCl has a melting point of -114 °C, while Cl₂ has a melting point of -101 °C. Hydrogen halides are not part of and cannot be extracted or isolated from elemental halides; rather, only via a chemical reaction that results in a chemical and structural change can hydrogen halides be formed from elemental halides. Hydrogen bromide is produced by reacting hydrogen and Br₂ at about 200-400 °C, a reaction that is typically catalyzed by platinum or asbestos. Hydrogen chloride is produced by reacting hydrogen and chlorine with one another. Therefore, elemental halogens are not hydrogen halides, and do not include hydrogen halides—Br₂ is not HBr and does not include HBr, and Cl₂ is not HCl and does not include HCl.

18. As shown by items 3-16 herein, chlorine has an atomic number of 17, meaning it has 17 protons and 17 electrons, giving it an electron configuration of 1s²2s²2p⁶3s²3p⁵, having 7 electrons in its outer shell. Bromine has an atomic number of 35, meaning it has 35 protons and 35 electrons, giving it an electron configuration of 1s²2s²2p⁶3s²3p⁶3d¹⁰4s²4p⁵, also having 7 electrons in its outer shell. According to the octet rule, a halogen atom desires to fill its outer shell with 8 electrons total by gaining one electron. A halide ion is a halogen atom that has accepted an electron from an