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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 08-077422- -00001-0000

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Tra: 2 PATENTES Eve: 1 REGDEPOSITO
Act: 329 CIOINFORMACION Folios: 53

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Señora Jefe de la
DIVISION DE NUEVAS CREACIONES
Superintendencia de Industria y Come
E. S. D.

Trámite : 002 Evento : 001 Actuación : 411

Referencia : Expediente No. 08077422
Asunto : Solicitud de patente para INYECCION PARA
HORNO DE VAPOR DE "BLACK PLANT"
Solicitante : BABCOCK & WILCOX POWER GENERATION GROUP, INC

DOCUMENTOS DE PRIORIDAD

1. Yo, Emilio FERRERO, en mi condición de apoderado de la sociedad BABCOCK & WILCOX POWER GENERATION GROUP, INC solicitante de la patente arriba identificada, por medio de este memorial presento los siguientes documentos:

1.1. Copia certificada de la solicitud No. 60/952,390 presentada en Estados Unidos de América el 27 de julio de 2007, cuya prioridad se reivindicó en el presente asunto, acompañada de su respectiva traducción al español.

1.2. Copia certificada de la solicitud No. 12/175,102 presentada en Estados Unidos de América el 17 de julio de 2008, cuya prioridad se reivindicó en este asunto, acompañada de su respectiva traducción al español.

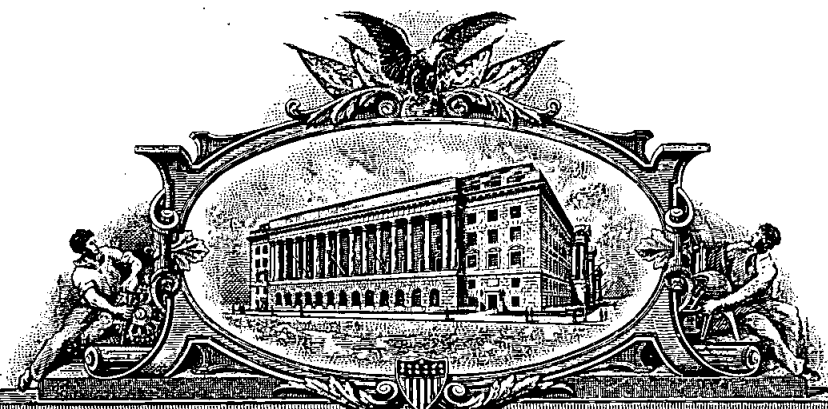
Señora Jefe,

EMILIO FERRERO

T.P.A. No. 31.929

COLO-16645-801-001-3
SCT\SCT\ID-136024\WPC16645
No. M-2008-136024\SCT

PA 1717223



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

September 04, 2008

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 60/952,390

FILING DATE: July 27, 2007

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US60/952,390

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office




W. MONTGOMERY
Certifying Officer

X

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Electronic Acknowledgement Receipt

EFS ID:	2020421
Application Number:	60952390
International Application Number:	
Confirmation Number:	1272
Title of Invention:	BLACK PLANT STEAM FURNACE INJECTION
First Named Inventor/Applicant Name:	Donald L. Wietzke
Customer Number:	41669
Filer:	Eric Marich
Filer Authorized By:	
Attorney Docket Number:	7238
Receipt Date:	27-JUL-2007
Filing Date:	
Time Stamp:	15:56:27
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	\$200
RAM confirmation Number	907
Deposit Account	501813
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Drawings	drawings.pdf	109388	no	2
			e28fb13d2e3f115ea2daac27dbb9d5bb3 bffa1c89		

Warnings:

Information:

2	Application Data Sheet	application_data_sheet.pdf	1105753	no	4
			ebd8625f6e76c4b6272c6ba2ed72b564 e5fe1940		

Warnings:

Information:

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3	Specification	7238_specification.pdf	633810	no	7
			9d3b1a79a33c0f64c639d37a3f11e664 3aacb79b		

Warnings:

Information:

4	Fee Worksheet (PTO-06)	fee-info.pdf	8097	no	2
			588bdfb5208d27e0564eea3e65848129 bf1d3a43		

Warnings:

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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.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	7238
		Application Number	
Title of Invention	Black Plant Steam Furnace Injection		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1				
Applicant Authority ☒ Inventor		☐ Legal Representative under 35 U.S.C. 117		☐ Party of Interest under 35 U.S.C. 118
Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	Donald	L.	Wietzke	
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service				
City	Carlsbad	State/Province	CA	Country of Residence i US
Citizenship under 37 CFR 1.41(b) i		US		
Mailing Address of Applicant:				
Address 1		7832 Quebrada Circle		
Address 2				
City	Carlsbad	State/Province	CA	
Postal Code	92009	Country i	US	
Applicant 2				
Applicant Authority ☒ Inventor		☐ Legal Representative under 35 U.S.C. 117		☐ Party of Interest under 35 U.S.C. 118
Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	Mikhail		Maryamchik	
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service				
City	Copley	State/Province	OH	Country of Residence i US
Citizenship under 37 CFR 1.41(b) i		US		
Mailing Address of Applicant:				
Address 1		2807 Summit Road		
Address 2				
City	Copley	State/Province	OH	
Postal Code	44321	Country i	US	
Applicant 3				
Applicant Authority ☒ Inventor		☐ Legal Representative under 35 U.S.C. 117		☐ Party of Interest under 35 U.S.C. 118
Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	David	J.	Walker	
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service				
City	Wadsworth	State/Province	OH	Country of Residence i US

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PTO/SB/14 (11-01)

Approved for use through 06/30/2010. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	7238
		Application Number	
Title of Invention	Black Plant Steam Furnace Injection		

Citizenship under 37 CFR 1.41(b) i		US	
Mailing Address of Applicant:			
Address 1		185 Dawna Drive	
Address 2			
City	Wadsworth	State/Province	OH
Postal Code	44281	Country i	US
Applicant 4			
Applicant Authority ☒ Inventor		☐ Legal Representative under 35 U.S.C. 117	
		☐ Party of Interest under 35 U.S.C. 118	
Prefix	Given Name	Middle Name	Family Name
Mr.	Michael		Szmania
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service			
City	Medina	State/Province	OH
Country of Residence i		US	
Citizenship under 37 CFR 1.41(b) i		US	
Mailing Address of Applicant:			
Address 1		1036 East Smith Road	
Address 2			
City	Medina	State/Province	OH
Postal Code	44256	Country i	US
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add			

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
☐ An Address is being provided for the correspondence information of this application.	
Customer Number	41669
Email Address	emarich@babcock.com Add Email Remove Email

Application Information:

Title of the Invention	Black Plant Steam Furnace Injection		
Attorney Docket Number	7238	Small Entity Status Claimed ☐	
Application Type			
Subject Matter			
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	2	Suggested Figure for Publication (if any)	

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	7238
		Application Number	
Title of Invention	Black Plant Steam Furnace Injection		

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	41669		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.			
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).			
Remove			
Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			☒ Yes ☐ No
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Assignee Information:

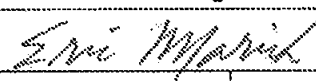
Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.	
Assignee 1	

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	7238
		Application Number	
Title of Invention	Black Plant Steam Furnace Injection		

If the Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information:				
Address 1				
Address 2				
City		State/Province		
Country		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee Data may be generated within this form by selecting the Add button.				

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.				
Signature			Date (YYYY-MM-DD)	2007-07-27
First Name	Eric	Last Name	Marich	Registration Number
			32265	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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[0001] BLACK PLANT STEAM FURNACE INJECTION

[0002] A circulating fluidized bed (CFB) boiler furnace has substantial thermal inertia which is attributed to hot bed material and uncooled parts of the solids separator at the furnace exit such as U-beams, hot refractory, etc. In case of plant power loss, a.k.a. a black plant condition, the Main Steam Stop Valve (MSV) typically closes to prevent a rapid steam/water side pressure reduction and water level drop in the boiler. The thermal inertia in the drum, tubes, headers and other boiler components will continue to promote steam generation lasting after the MSV closing. In order to prevent steam pressure buildup that would trigger a safety valve opening with a corresponding rapid water level drop in the boiler and to provide cooling of superheater surface subjected to residual heat of the uncooled parts of the boiler components, such as or in particular on a CFB provided with U-beam solids separator, a steam relief valve would open allowing steam to bleed through the steam side of the superheater into the atmosphere or to the steam user (e.g., when the steam is used for heating), typically in a controlled manner.

[0003] As in the case of an open MSV or safety valve, this steam bleed results in a lowering of the water level in the boiler circulation system. If the water level recedes below the furnace roof, it will result in portions of the tubes being uncooled, and those uncooled tubes which are exposed to the residual heat of the uncooled parts of the solids separator may be damaged. In order to prevent this from happening, the boiler may be provided with sufficient steam drum capacity and/or an independently powered boiler water pump that would maintain a safe water level in the boiler. However, providing this extra capacity of the steam drum and/or an independently powered boiler water pump adds to the boiler cost.

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[0004] Accordingly one aspect of the present invention is drawn a system and method for reducing/eliminating the additional cost associated with providing this extra capacity of the steam drum and/or and independently powered boiler water pump. This is achieved by discharging the steam bleed into the boiler furnace. The steam discharge would be conducted in a controlled manner.

[0005] In another aspect of the present invention, the CFB boiler may be equipped with a selective non catalytic reduction (SNCR) system utilizing steam as a carrier for a NOx reducing agent, e.g. ammonia, with the discharge nozzles of the SNCR system provided and located so as to discharge the steam into the furnace. According to the invention, these same SNCR system nozzles may thus be used for discharging the steam bleed into the furnace in case of a black plant condition.

[0006] When steam is discharged into the furnace, its temperature (typically, within the range of 300 F to 750 F) is substantially lower than that of the uncooled parts of the solids separator (typically, 1400 F to 1700 F). Therefore, the steam discharge will accelerate their cooling down to the temperature level safe for the material of potentially uncooled tubes (typically, 900 F to 1000 F) thus reducing or eliminating the need for extra capacity of the steam drum and/or an independently powered boiler water pump.

[0007] BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The two sheets of Figs. are schematic illustrations of a CFB boiler equipped with the apparatus of the present invention to accommodate a black plant condition, the first Fig. illustrating application of the invention to a CFB boiler without an SNCR system, while the second Fig. illustrates application of the invention to a CFB boiler with an SNCR system.

[0009] DESCRIPTION OF THE INVENTION

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[00010] The general purpose for black plant procedures and equipment is to allow the boiler to decay pressure and the setting to cool down to stable conditions as quickly as practical, without allowing water level to drop below the furnace roof, following a black plant trip. The follow provides general background information and outline of how the present invention would be applied to deal with a black plant condition, and particularly as applied to a CFB boiler experiencing a black plant condition.

[00011] After a black plant trip, the furnace operation solids inventory will generally collapse to the floor of the furnace at the bed operating temperature just prior to trip. This inventory will continue to transfer heat to the lower furnace walls and generate steam for some time; although lower furnace refractory and the 'self insulation' by the boundary layer of the bed against the furnace walls tend to slow the heat transfer. Even with the lower steaming rate, with main steam stop valves failing closed at trip, the additional steam generation will tend to raise steam pressure and tend to reduce drum water level as that water becomes steam. Taken all together:

[00012] - the raising steam pressure will typically lead to lifting one or more of the safety valves on main steam outlet and drum

[00013] - additional steam production from the slumped bed and initial collapse of steam voids in circulating water will tend to quickly reduce water level

[00014] - water level tends to be reduced even more quickly should safety valve(s) lift and allow the collapse of circulating water steam voids more readily.

[00015] For the CFB, upon a black plant trip the U-beams represent a significant thermal storage mass which will continue to radiate heat to surrounding areas of the boiler setting for some period of time. Specifically, the water cooled U-beam / rear wall support tubes will continue to receive heat from the U-beams at elevated temperature similar to normal operation. As in normal operation, so long as these tubes contain

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water, they will maintain acceptable temperatures and stress values. Should the water level fall below the roof, some portion of these tubes may only have steam cooling, and the tube metal temperature would rise. Even though low alloy steel tubes have been used for the U-beam and rear wall support tubes (with ability to maintain normal operation stress levels to temperatures over normal working temperature) loss of water in the tubes while the U-beams are still near their normal operation temperature could result in tube temperature where the normal operation stress in the tube exceeds allowable stress at that temperature.

[00016] To counter the conditions that lead to rapid water loss to below the furnace roof, the following actions or method steps are employed:

[00017] 1) controlled venting of steam both into the furnace setting and to the atmosphere as required to suppress pressure rise and help reduce chance of lifting safety valves.

[00018] 1A) Initial venting of approximately 5 - 10% (boiler maximum continuous rating) BMCR steam flow will be through the steam bleed line from the attemperator inlet header, through a high pressure reducing station and delivery to the SNCR system for delivery to the furnace through one or more levels of SNCR injection ports. The number of injection ports used will depend upon desired steam venting capability. This steam injection will help cool the U-beams.

[00019] 1B) additional venting of an additional 5 - 10% BMCR steam flow through a power (pneumatic) operated ball valve on the main steam outlet lead.

[00020] 2) operation of back up 'dribble pump' to main water flow to the drum to offset water lost through venting of steam produced by the slumped bed inventory and other thermal energy stored in the mass of the boiler setting.

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[00021] Projected sequence of operations on Black Plant Trip include:

[00022] A) DCS will continue to run on UPS

[00023] B) For valves that need to be automatically maneuvered after trip, UPS will be available for solenoid operation (if not DCS powered) and adequate air receiver capacity will be available to allow operation.

[00024] C) It is currently assumed that the turbine stop valves (or a main steam stop valve) will close and stop flow of main steam out of the boiler. This will tend to make the drum pressure rise.

[00025] D) Forced draft and ID fan dampers will 'fail in place' on black plant trip and allow for flow path through the through the unit.

[00026] E-1) Should the SNCR system be in operation, automatically and immediately close the 'normal' low pressure supply steam supply and maneuver system valves to accept steam from bleed point off the attemperator inlet header.

[00027] E-2) Automatically maneuver the discharge valves for the SNCR vaporization / mixing skid so that both levels of SNCR injectors are available to inject steam into the furnace.

[00028] E-3) Automatically, and immediately on trip and closure of main steam stop valves (and coordinated with closure of normal SNCR steam supply when SNCR is in operation), begin bleed of a high pressure steam stream from the attemperator inlet header through the high pressure reducing station and(s) and the SNCR mixing and injection ports into the furnace. This steam bleed / pressure reduction equipment will be sized for approximately 5% BMCR steam flow.

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[00029] F) Monitor pressure rise at the main steam outlet lead and open power operated vent if pressure rise continues to rise and approaches the SSH outlet safety valve lift pressure by about 25 – 30 psig.

[00030] G) Operator(s) commence to valve in and start the dribble pump. Whether direct driven, or motor driven by power from back-up generator or auxiliary power feed to the plant; the plan should be for the pump to be capable to supply water to drum in no more than 5 to 7 minutes. The dribble pump should be capable to supply the drum 10% or more of MCR feedwater flow at normal operation pressure. Dribble pump operation should be planned for a minimum of 45 minutes from the time it is started and water flow to the boiler initiated.

[00031] H) Monitor steam pressure and drum level. As needed, open the power operated vent valve to accommodate more pressure relief.

[00032] I) Monitor U-Beam temperature. To the extent that steam pressure has started falling away from lift pressure for any safety valves, stop SNCR steam venting to furnace when the temperature measured in second U-beam area thermocouple grid has cooled to 850° - 900°F.

[00033] J) Continue dribble pump operation until not supported by DA storage level, or the drum level is stable at NWL or within 3 – 4" below normal water level (NWL).

[00034] K) Restore unit to normal operation configuration when power supply to the plant is re-established.

SA

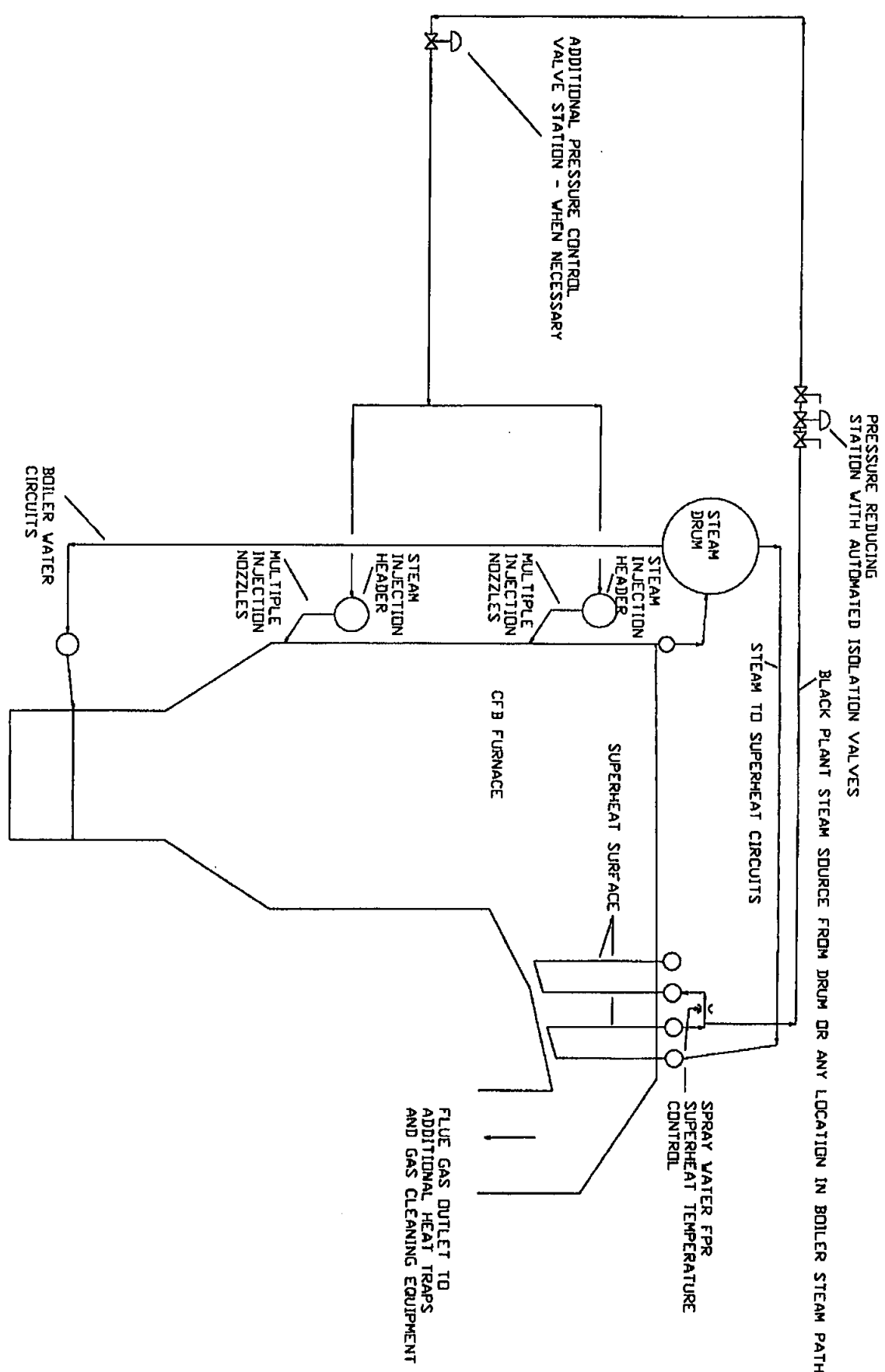
CLAIMS

We claim:

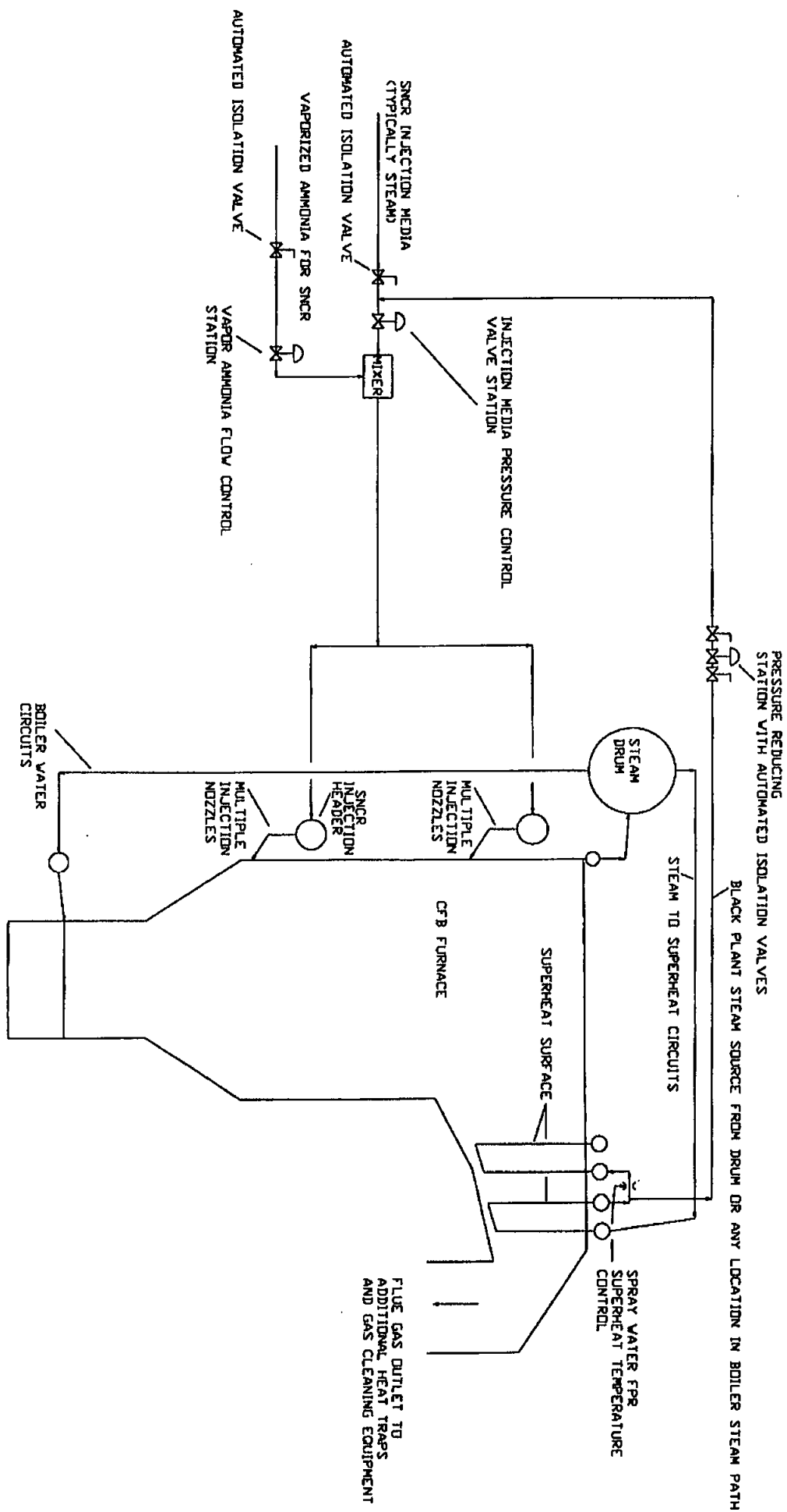
1. A CFB boiler comprising a furnace, a solids separator at the furnace exit, a water circulation system which may include a steam drum, and a steam discharge system with a relief valve, the steam discharge system for discharging steam into the furnace in case of a black plant condition.
2. The CFB boiler according to claim 1, wherein the CFB boiler is equipped with an SNCR system utilizing steam as a carrier for a NOx reducing agent, the SNCR system including discharge nozzles for discharging steam into the furnace, the discharge nozzles being used as part of the steam discharge system for discharging steam into the furnace in case of a black plant condition.
3. The CFB boiler according to claims 1 or 2, wherein the steam discharge system is operative to discharge steam into the furnace in case of a black plant condition, the steam discharge into the furnace being conducted in a controlled manner.
4. The system for rapidly cooling a furnace of a boiler during a black plant condition substantially as shown and described.
5. The method for rapidly cooling a furnace of a boiler during a black plant condition substantially as shown and described.

X

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BLACK PLANT STEAM FURNACE INJECTION
FOR CFB BOILER WITH NO SNCR SYSTEM



BLACK PLANT STEAM FURNACE INJECTION THROUGH SNCR SYSTEM FOR CFB BOILER

TRADUCCIÓN OFICIAL 234/2008 DE UN DOCUMENTO ESCRITO EN IDIOMA INGLÉS REALIZADA POR EDUARDO CALADO NOGUERA, TRADUCTOR OFICIAL AUTORIZADO POR RESOLUCIÓN 541 DEL 27 DE FEBRERO DE 1976 Y DEBIDAMENTE INSCRITO ANTE EL MINISTERIO DE RELACIONES EXTERIORES DE COLOMBIA.

ESTADOS UNIDOS DE AMÉRICA

A quien corresponda:

DEPARTAMENTO DE COMERCIO DE ESTADOS UNIDOS
OFICINA DE MARCAS Y PATENTES DE ESTADOS UNIDOS

4 de septiembre de 2008

Por el presente se certifica que se adjunta una copia verídica tomada de los registros de la OFICINA DE MARCAS Y PATENTES DE ESTADOS UNIDOS, sobre los documentos de la solicitud de patente que se identifica a continuación y que cumplieron con los requisitos para otorgarles una fecha de radicación de acuerdo con la disposición 35 USC 111.

NÚMERO DE SOLICITUD : 60/952,390

FECHA DE RADICACIÓN. 27 de julio de 2007

EL CÓDIGO DE PAIS Y EL NÚMERO DE SU SOLICITUD DE PRIORIDAD A EMPLEARSE PARA RADICACIÓN EN EL EXTRANJERO, DE CONFORMIDAD CON LA CONVENCIÓN DE PARIS ES US60/952,390

POR AUTORIZACIÓN DEL SUBSECRETARIO DE COMERCIO PARA PROPIEDAD INTELECTUAL Y EL DIRECTOR DE LA OFICINA DE MARCAS Y PATENTES DE ESTADOS UNIDOS.

FIRMADO. W. MONTGOMERY, funcionario certificador.

RECIBO DE RECONOCIMIENTO ELECTRÓNICO

EFS ID	2020421
NÚMERO DE SOLICITUD	60952390
NÚMERO DE SOLICITUD	

INTERNACIONAL	
NÚMERO DE CONFIRMACIÓN	1272
TÍTULO DEL INVENTO	INYECCIÓN DE HORNO DE VAPOR DE BLACK PLANT
PRIMER INVENTOR NOMBRADO/ NOMBRE DEL SOLICITANTE	DONALD L. WIETZKE
NÚMERO DEL CLIENTE	41669
PRESENTADOR	ERIC MARICH
PRESENTADOR AUTORIZADO POR	
NÚMERO DE EXPEDIENTE DE ABOGADO	7238
FECHA DE RECIBO	27 DE JULIO DE 2007
FECHA DE PRESENTACIÓN	
SELLO DE LA HORA	15:56:27
TIPO DE SOLICITUD	PROVISIONAL

INFORMACIÓN DE PAGO

PRESENTADO CON PAGO: SÍ

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honorarios indicados y acreditar cualquier pago adicional en
la forma siguiente:

CARGAR LOS HONORARIOS ADICIONALES REQUERIDOS BAJO 37 C.F.R,
SECCION 1.16 Y 1.17.

REIVINDICACIONES

Reivindicamos:

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1. Una caldera CFB que comprende un horno, un separador de sólidos en la puerta del horno, un sistema de circulación de agua que puede incluir un colector de vapor, un sistema de descarga de vapor con una válvula de alivio, siendo el sistema de descarga de vapor para descargar el mismo dentro del horno en caso de una condición black plant.
2. La caldera CFB de conformidad con la Reivindicación 1, en la cual la caldera CFB está equipada con un sistema SNCR que usa vapor como portador para un agente reductor Nox, en la cual el sistema SNCR incluye boquillas de descarga para verter vapor en el horno. Dichas boquillas de descarga se usan como parte del sistema de descarga de vapor para realizar descarga de vapor en el horno, en caso de una condición de black plant.
3. La caldera CFB de conformidad con las reivindicaciones 1 o 2, en la cual el sistema de descarga de vapor sirve para descargar vapor en el horno en caso de una condición black plant, en el cual la descarga hacia el horno se realiza en forma controlada.
4. El sistema para enfriar rápidamente un horno de una caldera durante una condición de black plant, en forma sustancial tal como se muestra y se describe aquí
5. El método para enfriar rápidamente un horno de una caldera durante una condición black plant, en forma sustancial tal como se muestra y describe aquí.

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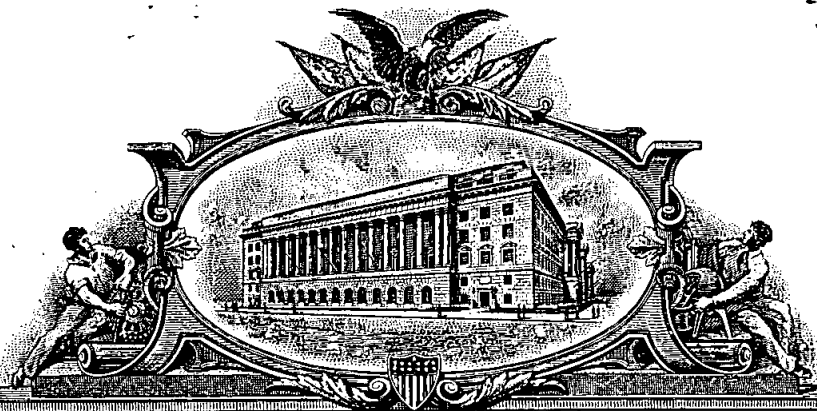
Bogotá, 8 de octubre de 2008.

Eduardo Calado N.
Eduardo Calado Noguera
TRADUCTOR OFICIAL
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August 11, 2008

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 12/175,102

FILING DATE: July 17, 2008

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US12/175,102

**By Authority of the
Under Secretary of Commerce for Intellectual Property
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W. MONTGOMERY
Certifying Officer

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Electronic Acknowledgement Receipt

EFS ID:	3635180
Application Number:	12175102
International Application Number:	
Confirmation Number:	9941
Title of Invention:	BLACK PLANT STEAM FURNACE INJECTION
First Named Inventor/Applicant Name:	Mikhail Maryamchik
Customer Number:	41669
Filer:	Eric Marich/Carolyn Mahoney
Filer Authorized By:	Eric Marich
Attorney Docket Number:	7238
Receipt Date:	17-JUL-2008
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Time Stamp:	16:30:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

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Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1030
RAM confirmation Number	2169
Deposit Account	501813
Authorized User	

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

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

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

6-3

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Specification	specification.pdf	2527949	no	11
			497b47eddd0e363d141f293f59dc29870073f7d2		
Warnings:					
Information:					
2	Claims	claims.pdf	473580	no	4
			14dc3d4ec7a49bfa83c87f8ee933c2eff9521e7		
Warnings:					
Information:					
3	Abstract	abstract.pdf	529262	no	1
			a35ba76adeeb2c1a7a62fa3d5511477430a6d155		
Warnings:					
Information:					
4	Drawings-only black and white line drawings	drawings.pdf	1403086	no	4
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Warnings:					
Information:					
5	Oath or Declaration filed	declaration.pdf	223590	no	1
			2e28bdb8a35bdca0aa1787c9d690489c3eccc9cd		
Warnings:					
Information:					
6	Fee Worksheet (PTO-06)	fee-info.pdf	8354	no	2
			6dfac14c8de50272e99df40c98736e8a06kd3373		
Warnings:					
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Total Files Size (in bytes):			5165821		

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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.

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BLACK PLANT STEAM FURNACE INJECTION

CROSS-REFERENCE TO RELATED APPLICATION

[0001] Priority is claimed to U.S. provisional patent application 60/952,390, filed July 27, 2007, the entire disclosure of which is incorporated herein by reference.

FIELD AND BACKGROUND OF INVENTION

[0002] The present invention relates, in general, to circulating fluidized bed (CFB) boiler arrangements and, more particularly, to a CFB boiler arrangement having a selective non-catalytic reduction (SNCR) system employed downstream of the CFB boiler furnace to achieve enhanced NO_x reduction capability.

[0003] CFB boiler arrangements are known and used in the production of steam for industrial processes and/or electric power generation. See, for example, U.S. Pat. Nos. 5,799,593, 4,992,085, and 4,891,052 to Belin et al.; U.S. Pat. No. 5,809,940 to James et al.; U.S. Pat. Nos. 5,378,253 and 5,435,820 to Daum et al.; and U.S. Pat. No. 5,343,830 to Alexander et al. In a CFB boiler furnace, reacting and non-reacting solids are entrained within the furnace enclosure by the upward gas flow that carries solids to the exit at the upper portion of the furnace, where the solids are separated by impact type particle separators. The impact type particle separators are placed in staggered arrays to present a path which may be navigated by the gas stream, but not the entrained particles. The collected solids are returned to the bottom of the furnace. One CFB boiler arrangement uses a plurality of impact type particle separators (or concave impingement members or U-beams) at the furnace exit to separate particles from the flue gas. While these separators can have a variety of configurations, they are commonly referred to as U-beams because they most often have a U-shaped configuration in cross-section.

[0004] Impact type particle separators are generally placed at the furnace exit and typically are not cooled. They are placed at the furnace outlet to protect the downstream heating surfaces, such as secondary and primary superheater surfaces, from erosion by solid particles. Thus, the U-beams are exposed to the high temperatures of the flowing stream of flue gas/solids, and the materials used for the U-beams must be sufficiently temperature resistant to provide adequate support and resistance to damage.

[0005] Impact type particle separators which are cooled or supported off a cooled structure are known. See, for example, U.S. Pat. Nos. 6,322,603 B1 to Walker, U.S. Pat. No. 6,500,221 B1 to Walker et al., and U.S. Pat. No. 6,454,824 B1 to Maryamchik et al.

[0006] A known impact type separator CFB boiler arrangement offered by The Babcock & Wilcox Company, based on an entirely water-cooled setting, is shown in FIGS. 1, 2 and 2A. This arrangement provides a furnace 10 having a gas-tight enclosure 11 suitable for operating with a positive pressure in the furnace 10, and provides a gas flow path for flue gas 15. It has no high temperature refractory lined flues in the vicinity of the primary particle separator U-beams 32 or in-furnace U-beams 34 and therefore requires minimal building space and reduces furnace refractory maintenance. This construction is possible due to the use of an impact type primary solids separator (U-beams 32) integrated into the boiler enclosure 11.

[0007] Fuel and sorbent are fed to the CFB bed through the lower front wall of furnace 10. The ash and spent sorbent are removed through drain pipes in the floor. The solids collected by the U-beams 32, 34 and multi-cyclone dust collector are returned through the rear wall to the lower portion of furnace 10.

[0008] Primary air enters furnace 10 through the distributor plate and secondary air is injected at elevations approximately 6 and 12 feet (1.8 and 3.7m) above the distributor plate through upper and lower overfire air headers.

[0009] The primary solids separation system, generally designated 30, includes staggered rows of U-shaped channel members, or U-beams 32, suspended from the

boiler roof. Material striking the U-beams 32 is separated from the flue gas 15, flows down the U-channel and discharges from the bottom.

[0010] A circulating fluidized bed (CFB) boiler furnace has substantial thermal inertia, which is attributed to hot bed material and un-cooled parts of the solids separator at the furnace exit such as U-beams, hot refractory, etc. In case of plant power loss, a.k.a. a black plant condition, the Main Steam Stop Valve (MSV) typically closes to prevent a rapid steam/water side pressure reduction and water level drop in the boiler. The thermal inertia of the drum, tubes, headers and other boiler components will continue to promote steam generation lasting after the MSV closing. In order to prevent steam pressure buildup that would trigger a safety valve opening with a corresponding rapid water level drop in the boiler, and to provide cooling of superheater surface subjected to residual heat of the un-cooled parts of the boiler components, such as a CFB boiler provided with U-beam solids separator, a steam relief valve would open allowing steam to bleed through the steam side of the superheater into the atmosphere or to the steam user (e.g., when the steam is used for heating), typically in a controlled manner.

[0011] As in the case of an open MSV or safety valve, this steam bleed results in a lowering of the water level in the boiler circulation system. If the water level recedes below the furnace roof, it will result in portions of the tubes being un-cooled, and those un-cooled tubes which are exposed to the residual heat of the un-cooled parts of the solids separator may be damaged. In order to prevent this from happening, the boiler may be provided with sufficient steam drum capacity and/or an independently powered boiler water pump that would maintain a safe water level in the boiler. However, providing this extra capacity of the steam drum and/or an independently powered boiler water pump adds to the boiler cost.

[0012] The combination of low temperatures and staged combustion allows fluidized-bed boilers, such as CFB boiler systems, to operate with low NOx emissions. Further NOx reduction can be controlled to lower values through the use of a selective non-catalytic reduction (SNCR) system consisting of ammonia injection near the U-

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beam elevation. An ammonia-based SNCR system includes storage and handling equipment for the ammonia; equipment for mixing the ammonia with a carrier (such as compressed air, steam or water) and injection equipment. The injection system, a key component, consists of nozzles generally located at various elevations on the furnace walls to match the expected flue gas operating temperature.

[0013] For additional details of the design and operation of circulating fluidized bed boilers and SNCR systems, the reader is referred to Chapter 17 and pages 34-13 to 34-15 of Steam/Its Generation and Use, 41st Edition, The Babcock & Wilcox Company, Barberton, Ohio, U.S.A., © 2005.

SUMMARY OF INVENTION

[0014] The present invention is drawn to a system and method for reducing or eliminating the additional cost associated with providing extra capacity in the steam drum and/or an independently powered boiler water pump to a boiler arrangement, in the event of a black plant condition. This is achieved by discharging a steam bleed stream into the boiler furnace. The steam discharge would be conducted in a controlled manner. When steam is discharged into the furnace, its temperature (typically, within the range of 300 F to 750 F) is substantially lower than that of the un-cooled parts, e.g. of the solids separator (typically, 1400 F to 1700 F). Therefore, the steam discharge will accelerate their cooling down to the temperature level safe for the material of potentially un-cooled tubes (typically, 900 F to 1000 F) thus reducing or eliminating the need for extra capacity of the steam drum and/or an independently powered boiler water pump, also known as a dribble pump. The invention advantageously simultaneously both reduces boiler pressure and cools hot boiler components, such as U-beams and associated support structures.

[0015] Accordingly, one aspect of the invention is drawn to a steam discharge system for use with a circulating fluidized bed (CFB) boiler arrangement during a black plant condition. The CFB boiler arrangement includes a CFB furnace with a solids

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separator system and a steam/water circuit for circulating steam and water. The steam discharge system is comprised of means for transporting steam from the steam/water circuit, along with means, connected to the means for transporting steam, for injecting the transported steam into the furnace, thereby cooling the solids separator system and reducing pressure in the steam/water circuit. The means for injecting the transported steam into the furnace may include a steam injection header and a plurality of injection nozzles. A dribble pump may be connected to a steam drum in the steam/water circuit to maintain water flow to the steam drum, thereby offsetting steam lost from the steam/water circuit by injection into the furnace. Steam may be obtained from an attemperator inlet header or the steam drum, or at any other point in the steam path in the steam/water circuit and the means for transporting steam may include a steam supply line connected between the steam/water circuit and the means for injecting steam into the furnace. The means for transporting steam may also include a pressure reducing station connected to a steam supply line. When used, the steam supply line and pressure reducing station may be sized for about 5% of boiler maximum continuous rating (BMCR) steam flow.

[0016] In another aspect of the present invention, the steam discharge system may be applied to a CFB boiler arrangement equipped with a selective non-catalytic reduction (SNCR) system utilizing steam as a carrier for a NOx reducing agent, such as ammonia, with the discharge nozzles of the SNCR system provided and located so as to discharge the steam and ammonia into the furnace. According to the invention, these same SNCR system nozzles may thus be used for discharging the steam bleed into the furnace in case of a black plant condition. Accordingly another aspect/object of the invention is drawn to a steam discharge system for use during a black plant condition with a boiler arrangement having a selective non-catalytic reduction system that employs steam as a flowing carrier gas for a NOx reduction agent. The boiler arrangement includes a steam/water circuit with a steam drum and a circulating fluidized bed furnace with a solids separator system. The steam discharge system also includes means for stopping the flowing carrier gas and NOx reduction agent, and a steam supply line having a pressure reducing station therein for supplying steam from

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the steam/water circuit to the selective non-catalytic reduction system. The steam discharge system also includes means for discharging the steam supplied from the steam/water circuit through the selective non-catalytic reduction system into the furnace, thereby cooling the solids separator system. The steam supply line and pressure reducing station may be sized for about 5% of BMCR steam flow. The steam discharge system may also include a dribble pump connected to the steam drum to maintain water flow to the steam drum, thereby offsetting the loss of steam supplied from the steam/water circuit and discharged into the furnace.

[0017] Yet another aspect of the invention is drawn to a method of cooling the hot boiler components of a boiler arrangement during a black plant condition. The boiler arrangement includes a boiler enclosure defining a gas flow path for transporting flue gas during normal operation. The method includes the steps of providing a source of steam, and discharging the steam into the gas flow path during a black plant condition, thereby cooling the hot boiler components. Where the boiler arrangement includes an SNCR system having a plurality of SNCR injection nozzles which discharge a mixture of steam and ammonia into the gas flow path during normal operation, the method step of discharging the steam into the gas flow path may include discharging steam solely through SNCR injection nozzles. Where the boiler arrangement includes a CFB furnace having an impact type particle separator, the step of discharging the steam into the gas flow path during a black plant condition serves to cool the impact type particle separator. Where the boiler arrangement includes a CFB furnace having an impact type particle separator comprised of U-beams, the method may include the steps of monitoring the temperature of the U-beams and continuing the steam discharge step until the temperature of the U-beams is about 850° - 900°F. The attemperator inlet header of a boiler arrangement may serve as the source of the steam, in which case the step of providing a source of steam includes transporting steam from the attemperator inlet header.

[0018] The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming part of this disclosure. For a better understanding of the present invention, and the operating advantages attained by

its use, reference is made to the accompanying drawings and descriptive matter, forming a part of this disclosure, in which a preferred embodiment of the invention is illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In the accompanying drawings, forming a part of this specification, and in which reference numerals shown in the drawings designate like or corresponding parts throughout the same:

[0020] FIG. 1 is a schematic illustration of a known CFB boiler arrangement;

[0021] FIGS. 2 and 2A are schematic illustrations of the upper portion of the CFB boiler of FIG. 1;

[0022] FIG. 3 is a schematic illustration of a CFB boiler arrangement according to the present invention; and

[0023] FIG. 4 is a schematic illustration of a CFB boiler arrangement according to a variation of the present invention, suitable for use in a boiler arrangement with an SNCR system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] The general purpose for black plant procedures and equipment is to allow the boiler pressure to decay and the boiler setting to cool down to stable conditions as quickly as practical, without allowing water level to drop below the furnace roof, following a black plant trip. The following provides general background information and outlines of how the present invention would be applied to deal with a black plant condition, and particularly as applied to a CFB boiler arrangement experiencing a black plant condition.

[0025] Referring now to FIGS. 3 and 4, the U-beams are impact type separators which collect and recycle solids back to the furnace 10. The impact type separators

serve to protect downstream heating surfaces, such as primary superheater 41, secondary superheater 42 and reheat surfaces from erosion. Attemperator 46 is an apparatus for reducing and controlling the temperature of a superheated fluid passing through it. This is accomplished by spraying high purity water 44 into an interconnecting steam pipe, usually between superheater stages 41, 42.

[0026] After a black plant trip, the furnace operation solids inventory of a CFB boiler arrangement 1 will generally collapse to the floor of the furnace 10 at the bed operating temperature just prior to trip. This inventory will continue to transfer heat to the lower walls of furnace 10 and generate steam for some time, even though the lower furnace refractory and the 'self insulation' by the boundary layer of the bed against the walls of furnace 10 tend to slow the heat transfer. Even with the lower steaming rate, with main steam stop valves failing closed at trip, the additional steam generation will tend to raise steam pressure and tend to reduce water level in drum 20 as that water becomes steam. Taken all together:

[0027] - the rising steam pressure will typically lead to lifting one or more of the safety valves on main steam outlet 65 and drum 20;

[0028] - additional steam production from the slumped bed and initial collapse of steam voids in circulating water will tend to quickly reduce water level; and

[0029] - water level tends to be reduced even more quickly should safety valve(s) lift and allow the collapse of circulating water steam voids more readily.

[0030] For the CFB furnace 10, upon a black plant trip the U-beams 32 represent a significant thermal storage mass which will continue to radiate heat to surrounding areas of the boiler setting for some period of time. Specifically, the water-cooled U-beam / rear wall support tubes 37 (see FIG. 2A) will continue to receive heat from the U-beams 32 at elevated temperature similar to normal operation. As in normal operation, so long as these tubes contain water, they will maintain acceptable temperatures and stress values. Should the water level fall below the roof, some portion of these tubes may only have steam cooling, and the tube metal temperature would rise. Even though low alloy steel tubes have been used for the U-beam and rear wall support tubes 37,

shown as SW membrane panel in FIG. 2A (with ability to maintain normal operation stress levels to temperatures over normal working temperature), loss of water in the tubes while the U-beams 32 are still near their normal operating temperature could result in tube temperature where the normal operation stress in the tube exceeds allowable stress at that temperature.

[0031] To counter the conditions that lead to rapid water loss to below the furnace roof, the following actions or method steps are employed:

[0032] 1) controlled venting of steam 115 both into the furnace 10 and to the atmosphere as required to suppress pressure rise and help reduce chance of lifting safety valves.

[0033] 2) initial venting of approximately 5 - 10% boiler maximum continuous rating (BMCR) steam flow through a steam discharge/injection system, generally designated 100. Steam discharge system 100 includes a steam bleed line 160 which transports steam 115 from a steam source located in the boiler steam path of steam/water circuit 60, such as steam drum 20 or preferably from attenuator inlet header 140, through a high pressure reducing station 150 and steam injection headers 110 to a plurality of injection nozzles 120, which discharge steam 115 into furnace 10. This steam injection will help cool the U-beams 32. Pressure reducing station 150 preferably is equipped with automated isolation valves 152, 154. For boiler arrangements equipped with an SNCR system 200 employing steam as a carrier gas for ammonia for delivery to the furnace 10 through one or more levels of SNCR injection nozzles or ports 220, steam discharge system 100 advantageously incorporates existing SNCR steam injection headers 210 and SNCR injection nozzles or ports 220. The number and size of injection ports used will depend upon desired steam venting capability.

[0034] 3) additional venting of an additional 5 - 10% BMCR steam flow through a power (pneumatic) operated ball valve 70 on the main steam outlet lead 65.

[0035] 4) operation of back up 'dribble pump' 170 to maintain water flow to the drum 20 to offset water lost through venting of steam 115 produced by the slumped bed inventory and other thermal energy stored in the mass of the boiler setting.

[0036] Projected sequence of operations on Black Plant Trip include:

[0037] A) A distributed control system (DCS) will continue to run on an uninterruptible power supply (UPS).

[0038] B) For valves that need to be automatically maneuvered after trip, UPS will be available for solenoid operation (if not DCS powered) and adequate air receiver capacity will be available to allow operation.

[0039] C) It is currently assumed that the turbine stop valves (or a main steam stop valve) will close and stop flow of main steam out of the boiler. This will tend to make the pressure rise in drum 20.

[0040] D) Forced draft and ID fan dampers will 'fail in place' on black plant trip and allow for a gas flow path through the unit.

[0041] E) Should an SNCR system 200 be in operation, automatically and immediately close the 'normal' low pressure supply steam supply valve 202 and maneuver system valves 150 to accept steam from bleed point off the attemperator inlet header 140. Automatically maneuver the discharge valves (not shown) for the SNCR vaporization / mixing skid 230 so that both levels of SNCR injectors 220 are available to inject steam 115 into the furnace 10.

[0042] F) Automatically, and immediately on trip and closure of main steam stop valves (and coordinated with closure of normal SNCR steam supply valve 202 when SNCR 200 is in operation), begin bleed of a high pressure steam stream 115 from the attemperator inlet header 140 through steam line bleed line 160 to the high pressure reducing station 150 and the SNCR mixing and injection ports 220 into the furnace 10. This steam bleed / pressure reduction equipment 160, 150 will preferably be sized for approximately 5% BMCR steam flow.

[0043] G) Monitor pressure rise at the main steam outlet lead 65, as is known in the art, and preferably open power operated vent 70 if pressure continues to rise and approaches the lift pressure of the secondary superheater (SSH) outlet safety valve by about 25 – 30 psig.

[0044] H) Operator(s) commence to valve in and start the dribble pump 170. Whether direct driven, or motor driven by power from back-up generator or auxiliary power feed to the plant; the plan should preferably be for the pump 170 to be capable to supply water to drum 20 in no more than 5 to 7 minutes. The dribble pump 170 should preferably be capable of supplying the drum 20 with 10% or more of maximum continuous rating (MCR) feedwater flow at normal operation pressure. Operation of dribble pump 170 should preferably be planned for a minimum of 45 minutes from the time it is started and water flow to the boiler is initiated.

[0045] I) Monitor steam pressure and drum level, as is known in the art. As needed, open the power operated vent valve 70 to accommodate more pressure relief.

[0046] J) Monitor U-Beam temperature. To the extent that steam pressure has started falling away from lift pressure for any safety valves, stop steam venting to furnace 10 when the temperature measured by temperature sensor 139 in U-beam area thermocouple grid has cooled to 850° - 900°F.

[0047] K) Continue operation of dribble pump 170 until not supported by deaerator storage level or the level of drum 20 is stable at normal water level (NWL) or within 3 - 4" below NWL.

[0048] L) Restore unit to normal operation configuration when power supply to the plant is re-established.

[0049] While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it is understood that the invention may be embodied otherwise without departing from such principles. For example, the present invention may be applied to new boiler or steam generator construction, or to the replacement, repair or modification of existing boilers or steam generators. In some embodiments of the invention, certain features of the invention may sometimes be used to advantage without a corresponding use of the other features. Accordingly, all such changes and embodiments properly fall within the scope of the following claims.

CLAIMS

We claim:

1. In a circulating fluidized bed boiler arrangement with a solids separator system and a steam/water circuit for circulating steam and water, a steam discharge system for use during a black plant condition, the steam discharge system comprising:
means for transporting steam from the steam/water circuit; and
means, connected to the means for transporting steam, for injecting the transported steam into the furnace, thereby cooling the solids separator system and reducing pressure in the steam/water circuit.
2. The steam discharge system of Claim 1, wherein the means for injecting the transported steam into the furnace further comprises a steam injection header and a plurality of injection nozzles.
3. The steam discharge system of Claim 1, wherein the means for injecting the transported steam into the furnace further comprises steam injection headers and injection nozzles of an SNCR system connected to the furnace.
4. The steam discharge system of Claim 1, wherein the steam/water circuit includes a steam drum and the steam discharge system further comprises a dribble pump connected to the steam drum to maintain water flow to the steam drum, thereby offsetting steam lost from the steam/water circuit by injection into the furnace.
5. The steam discharge system of Claim 1, wherein the boiler arrangement further comprises an attemperator inlet header, and the means for transporting steam comprises a steam supply line connected between the attemperator inlet header and the means for injecting steam into the furnace.
6. The steam discharge system of Claim 5, further comprising a pressure reducing station connected to the steam supply line.

7. The steam discharge system of Claim 6, wherein the steam supply line and pressure reducing station are sized for about 5% of BMCR steam flow.

8. In a boiler arrangement having a steam/water circuit with a steam drum, a circulating fluidized bed furnace with a solids separator system, and a selective non-catalytic reduction system that employs steam as a flowing carrier gas for a NO_x reduction agent, a steam discharge system for use during a black plant condition, the steam discharge system comprising:

means for stopping the flowing carrier gas and NO_x reduction agent;

a steam supply line having a pressure reducing station therein for supplying steam from the steam/water circuit to the selective non-catalytic reduction system; and 125

means for discharging the steam supplied from the steam/water circuit through the selective non-catalytic reduction system into the furnace, thereby cooling the solids separator system.

9. The steam discharge system of Claim 8, wherein the steam supply line and pressure reducing station are sized for about 5% of BMCR steam flow.

10. The steam discharge system of Claim 8, wherein the steam discharge system further comprises a dribble pump connected to the steam drum to maintain water flow to the steam drum, thereby offsetting the loss of steam supplied from the steam/water circuit and discharged into the furnace.

11. The steam discharge system of Claim 8, wherein the boiler arrangement further comprises an attemperator inlet header, and the steam supply line connects the attemperator inlet header to the selective non-catalytic reduction system.

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12. A method of cooling the hot boiler components of a boiler arrangement during a black plant condition, the boiler arrangement having a boiler enclosure defining a gas flow path for transporting flue gas during normal operation, the method comprising:

providing a source of steam; and

discharging the steam into the gas flow path during a black plant condition, thereby cooling the hot boiler components.

13. The method of Claim 12, wherein the boiler arrangement further comprises an SNCR system having a plurality of SNCR injection nozzles which discharge a mixture of steam and ammonia into the gas flow path during normal operation, and wherein the step of discharging the steam into the gas flow path comprises discharging solely steam into the boiler through SNCR injection nozzles.

14. The method of Claim 13, wherein the boiler arrangement further comprises a CFB furnace having an impact type particle separator with U-beams and the method further comprises the steps of monitoring the temperature of the U-beams and continuing the steam discharge step until the temperature of the U-beams is about 850° - 900°F.

15. The method of Claim 14, wherein the boiler arrangement further comprises an attemperator inlet header and wherein the step of providing a source of steam comprises transporting steam from the attemperator inlet header.

16. The method of Claim 12, wherein the boiler arrangement further comprises a CFB furnace having an impact type particle separator, and wherein the step of discharging the steam into the gas flow path during a black plant condition, thereby cools the impact type particle separator.

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17. The method of Claim 16, wherein the impact type particle separator comprises U-beams and the method further comprises the steps of monitoring the temperature of the U-beams and continuing the steam discharge step until the temperature of the U-beams is about 850° - 900°F.

18. The method of Claim 12, wherein the boiler arrangement further comprises an attemperator inlet header and wherein the step of providing a source of steam comprises transporting steam from the attemperator inlet header.

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ABSTRACT

[0050] A system and method for quickly cooling and de-pressurizing a boiler arrangement in the event of a plant power loss, a.k.a. a black plant condition. A steam discharge system injects steam from the steam/water circuit into the furnace, thereby both cooling components of the boiler arrangement and reducing pressure in the steam/water circuit. This reduces or eliminates the additional cost associated with providing extra capacity in a steam drum and/or an independently powered boiler water pump. The system and method is particularly useful for quickly cooling the U-beams of a circulating fluidized bed (CFB) boiler during a black plant condition. In application to boiler arrangements with a selective non-catalytic reduction (SNCR) system employing steam as a carrier for a NO_x reducing agent, the steam discharge system advantageously uses the discharge nozzles of the SNCR system to inject the steam into the furnace.

DECLARATION FOR PATENT APPLICATION

Docket No. 7238

As below named inventor, I hereby declare that: My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject **BLACK PLANT STEAM FURNACE INJECTION**, the specification of which:

(check) one ☒ is attached hereto

☐ was filed on _____ as United States or PCT International application Serial No. _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 USC §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or under §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International application, having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Claimed

Yes ☐ No ☐

(Number)

(Country)

(Day/Month/Year Filed)

I hereby claim the benefit under 35 USC §119(e) of any United States provisional application(s) listed below.

60/952,390
(Application Serial No.)

27/07/2007
(Day/Month/Year Filed)

I hereby claim the benefit under 35 USC §120 of any United States application(s), or under §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 USC §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which become available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Serial No.)

(Filing Date)

(Status—patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: (1) Eric Marich, Reg. No. 32,265; (2) D. Neil LaHaye, Reg. No. 30,767; and (3) Michael J. Seymour, Reg. No. 54,436.

Address all telephone calls to
Address all correspondence to

ERIC MARICH at telephone no. (330) 860-6605
Babcock & Wilcox Power Generation Group, Inc.
Patent Department – BVCB2K
20 South Van Buren Avenue
Barberton, OH 44203-0351

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PATENT TRADEMARK OFFICE

I hereby 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 fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor **Mikhail Maryamchik**

Inventor's signature _____

Date _____ Citizenship US
Residence Fairlawn, Ohio
Post office address 3800 Rosemont Blvd. #113D
Fairlawn, Ohio 44333

Full name of second inventor, if any **Michael J. Szmania**

Inventor's signature _____

Date _____ Citizenship US
Residence Medina, Ohio
Post office address 1036 East Smith Road
Medina, Ohio 44256

Full name of third inventor, if any **David J. Walker**

Inventor's signature _____

Date _____ Citizenship US
Residence Wadsworth, Ohio
Post office address 185 Dawna Drive
Wadsworth, Ohio 44281

Full name of fourth inventor, if any **Donald L. Wietzke**

Inventor's signature _____

Date _____ Citizenship US
Residence Carlsbad, California
Post office address 7832 Quebrada Circle
Carlsbad, California 92009

82-10

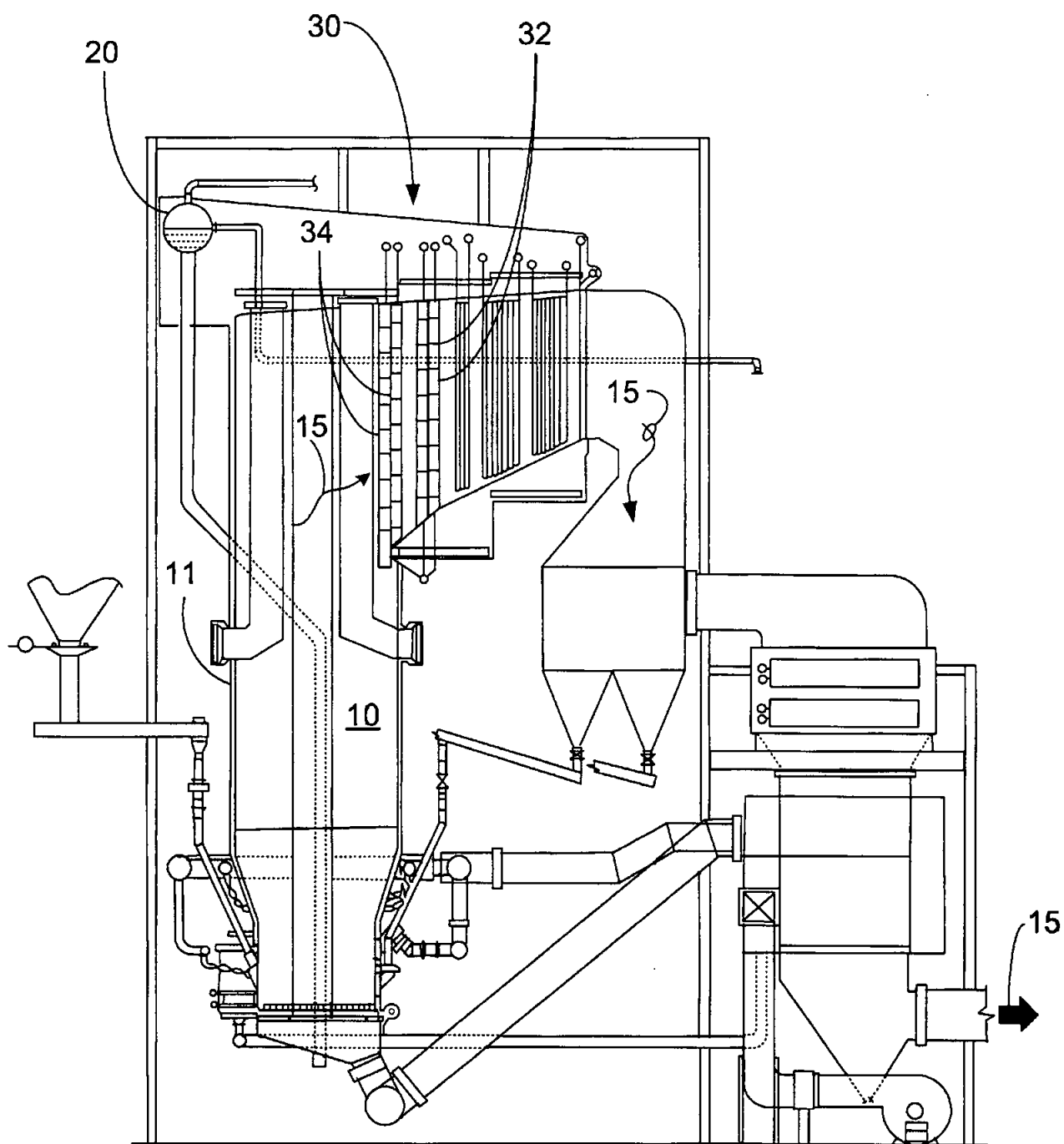


FIG. 1

83 14

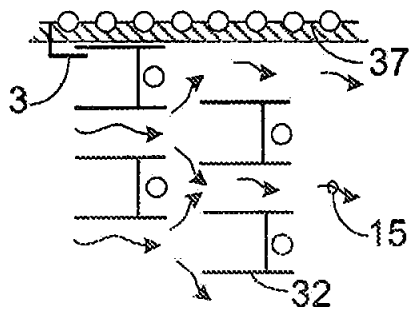


FIG. 2A

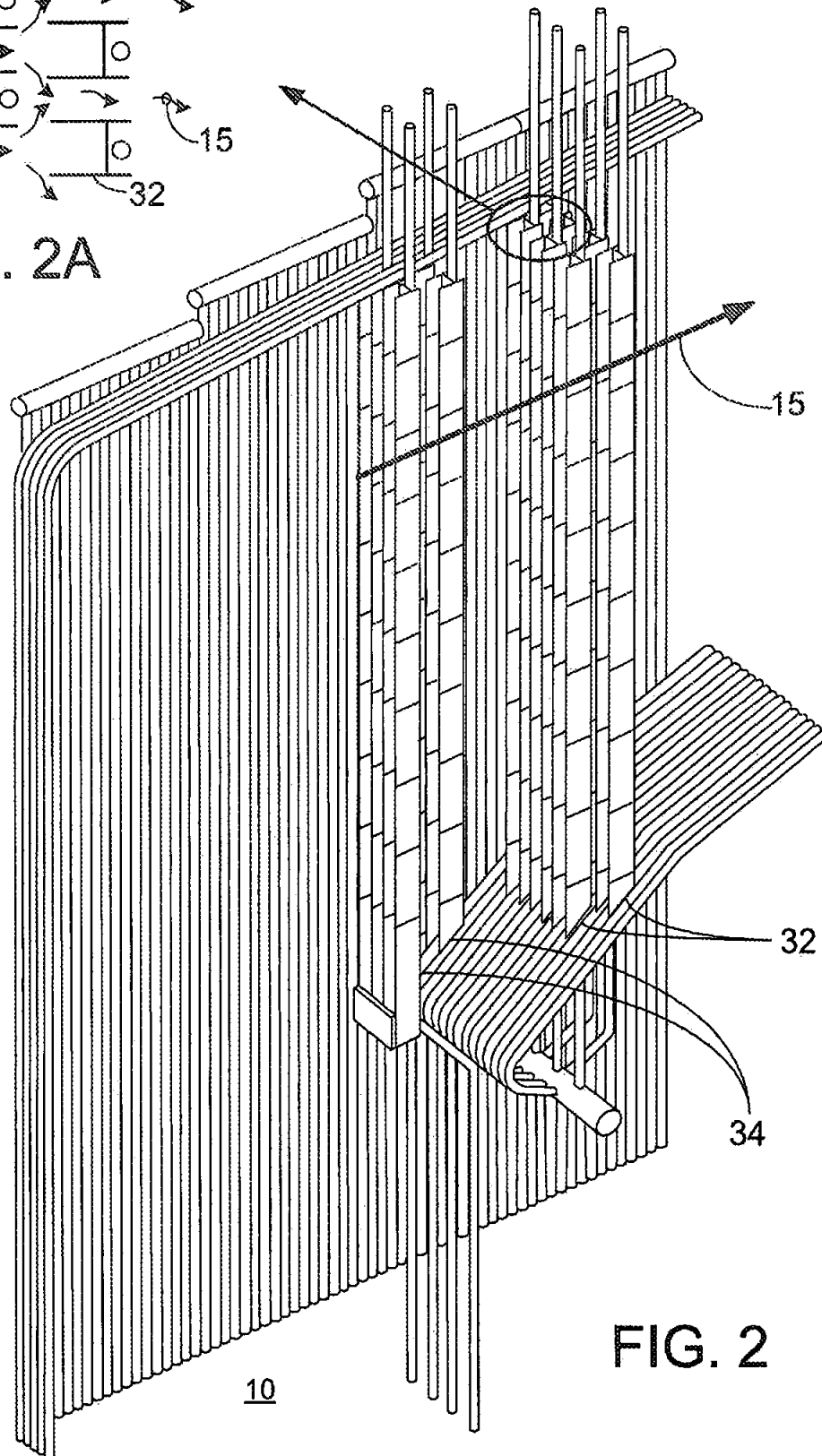
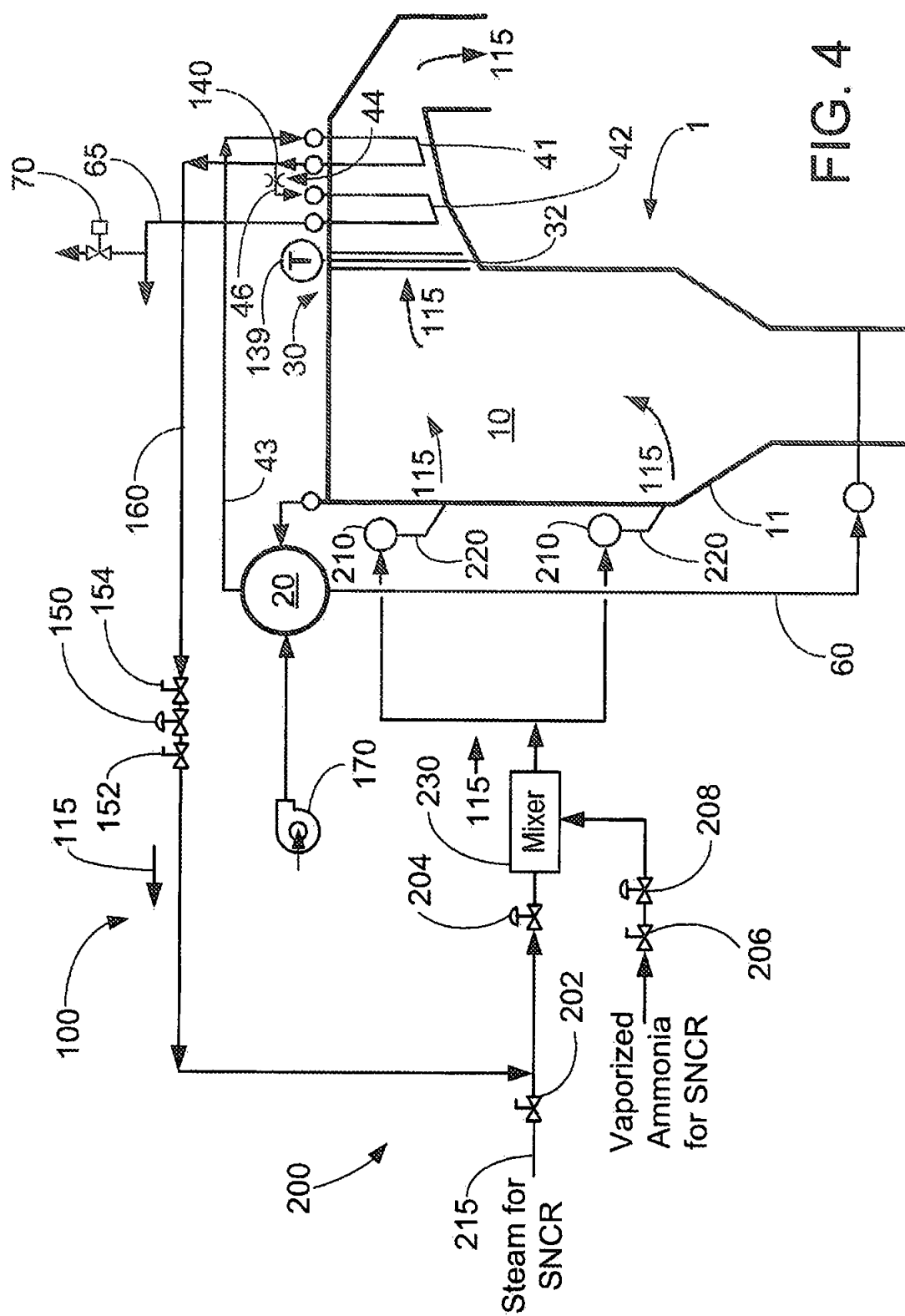


FIG. 2

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TRADUCCIÓN OFICIAL No. 06.17/08a realizada por Diego Vargas, Traductor Oficial, Resolución No. 0001 de 1999 del Ministerio de Justicia y registrado ante el Ministerio de Relaciones Exteriores de Colombia.



LOS ESTADOS UNIDOS DE AMÉRICA

A TODOS A QUIENES ESTOS PRESENTES LLEGAREN:

DEPARTAMENTO DE COMERCIO DE LOS ESTADOS UNIDOS

OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS

11 de agosto de 2008

EL PRESENTE ES PARA CERTIFICAR QUE LA ADJUNTA ES UNA COPIA FIEL DE LOS ARCHIVOS DE LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS DE AQUELLOS DOCUMENTOS DE LA SOLICITUD DE PATENTE IDENTIFICADA A CONTINUACIÓN QUE HAN CUMPLIDO CON LOS REQUISITOS PARA SERLES OTORGADA UNA FECHA DE PRESENTACIÓN DE CONFORMIDAD CON EL ARTÍCULO 111 DEL TÍTULO 35 DEL USC.

NÚMERO DE SOLICITUD: 12/175,102

FECHA DE PRESENTACIÓN: 17 de julio de 2008

EL CÓDIGO DE PAÍS Y NÚMERO DE SU SOLICITUD PRIORITARIA, PARA USO EN SOLICITUDES EXTRANJERAS DE CONFORMIDAD CON LA CONVENCIÓN DE PARÍS, ES US12/175,102

Por autorización del Subsecretario de Comercio para la Propiedad Intelectual y Director de la Oficina de Marcas y Patentes de los Estados Unidos

Firma ilegible
W. MONTGOMERY
Funcionario de Autenticaciones

REIVINDICACIONES

Reivindicamos:

1. En una disposición de caldera de lecho fluidizado circulante con un sistema de separador de sólidos y un circuito de vapor/agua para circular vapor y agua, un sistema de descarga de vapor para uso durante una condición de "black plant", el sistema de descarga de vapor comprende:

medios para transportar vapor del circuito de vapor/agua; y

medios, conectados a los medios para transportar vapor, para inyectar el vapor transportado dentro del horno, enfriando así el sistema separador de sólidos y reduciendo la presión en el circuito de vapor/agua.

2. El sistema de descarga de vapor de la Reivindicación 1, en donde los medios para inyectar el vapor transportado dentro del horno comprende adicionalmente un cabezal de inyección de vapor y una pluralidad de boquillas para inyección.

3. El sistema de descarga de vapor de la Reivindicación 1, en donde los medios para inyectar el vapor transportado dentro del horno comprende adicionalmente cabezales de inyección de vapor y boquillas para inyección de un sistema SNCR conectado al horno.

4. El sistema de descarga de vapor de la Reivindicación 1, en donde el circuito de vapor/agua incluye un tambor de vapor y el sistema de descarga de vapor que comprende adicionalmente una bomba de goteo conectada al tambor de vapor para mantener el flujo de agua al tambor de vapor, compensando así por el vapor

perdido del circuito de vapor/agua por inyección dentro del horno.

5. El sistema de descarga de vapor de la Reivindicación 1, en donde la disposición de caldera comprende adicionalmente un cabezal de entrada del atemperador, y los medios para transportar vapor comprenden un conducto de suministro de vapor conectado entre el cabezal de entrada del atemperador y los medios para inyectar vapor dentro del horno.

6. El sistema de descarga de vapor de la Reivindicación 5, que comprende adicionalmente una estación de reducción de presión conectada al conducto de suministro de vapor.

7. El sistema de descarga de vapor de la Reivindicación 6, en donde el conducto de suministro de vapor y la estación de reducción de presión se calibran aproximadamente 5% del flujo de vapor BMCR.

8. En una disposición de caldera que tiene un circuito de vapor/agua con un tambor de vapor, un horno de lecho fluidizado circulante con un sistema separador de sólidos, y un sistema de reducción no catalítica selectiva que emplea vapor como un gas portador de flujo para un agente de reducción de NO_x , un sistema de descarga de vapor para uso durante una condición de "black plant", el sistema de descarga de vapor comprende:

medios para detener el gas portador de flujo y el agente de reducción NO_x ;

un conducto de suministro de vapor que tiene una estación de reducción de presión allí para suministrar vapor del circuito de vapor/agua al sistema de reducción no catalítico selectivo; y 125

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medios para descargar el vapor suministrado desde el circuito de vapor/agua a través del sistema de reducción no catalítico selectivo dentro del horno, enfriando así el sistema separador de sólidos.

9. El sistema de descarga de vapor de la Reivindicación 8, en donde el conducto de suministro de vapor y la estación de reducción de presión se calibran para aproximadamente 5% del flujo de vapor BMCR.

10. El sistema de descarga de vapor de la Reivindicación 8, en donde el sistema de descarga de vapor comprende adicionalmente una bomba de goteo conectada al tambor de vapor para mantener el flujo de agua al tambor de vapor, compensando así la pérdida por el vapor suministrado desde el circuito de vapor/agua y descargado dentro del horno.

11. El sistema de descarga de vapor de la Reivindicación 8, en donde la disposición de caldera comprende adicionalmente un cabezal de entrada del atemperador, y el conducto de suministro de vapor conecta el cabezal de entrada del atemperador al sistema de sistema de reducción no catalítico selectivo.

12. Un método para enfriar los componentes de caldera caliente de una disposición de caldera durante una condición de "black plant", la disposición de caldera que tiene un recinto de caldera que define una ruta de flujo de gas para transportar gas de escape durante operación normal, el método comprende:

proporcionar una fuente de vapor; y

descargar el vapor dentro de la ruta de flujo de gas durante una condición de "black plant", enfriando así los componentes de caldera caliente.

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13. El método de la Reivindicación 12, en donde la disposición de caldera comprende adicionalmente un sistema SNCR que tiene una pluralidad de boquillas de inyección en SNCR que descargan una mezcla de vapor y amoníaco dentro de la ruta de flujo de gas durante operación normal, y en donde la etapa de descargar el vapor dentro de la ruta de flujo de gas comprende descargar únicamente vapor dentro de la caldera a través de las boquillas de inyección SNCR.

14. El método de la Reivindicación 13, en donde la disposición de caldera comprende adicionalmente un horno CFB que tiene un separador de partícula de tipo impacto con vigas en U y el método comprende adicionalmente las etapas de monitorear la temperatura de las vigas en U y continuar la etapa de descarga de vapor hasta que la temperatura de las vigas en U es de aproximadamente 850°-900° F.

15. El método de la Reivindicación 14, en donde la disposición de caldera comprende adicionalmente un cabezal de entrada del atemperador y en donde la etapa de proporcionar una fuente de vapor comprende transportar vapor desde el cabezal de entrada del atemperador.

16. El método de la Reivindicación 12, en donde la disposición de caldera comprende adicionalmente un horno CFB que tiene un separador de partícula de tipo impacto y en donde la etapa de descargar el vapor dentro de la ruta de flujo de gas durante una condición de "black plant" enfría de esta manera el separador de partículas de tipo impacto.

17. El método de la Reivindicación 16, en donde el separador de partículas de tipo impacto comprende vigas en U y el

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método comprende adicionalmente las etapas de monitorear la temperatura de las vigas en U y continuar la etapa de descarga de vapor hasta que la temperatura de las vigas en U es de aproximadamente 850°- 900° F.

18. El método de la Reivindicación 12, en donde la disposición de caldera comprende adicionalmente un cabezal de entrada al atemperador y en donde la etapa de proporcionar una fuente de vapor comprende transportar vapor desde el cabezal de entrada del atemperador.

Es traducción fiel y completa de la cual se deja copia en esta oficina para su confrontación.

DVZ\DVZ\ID-134645\WPCL002G\COLO 16645-801-001-3


DIEGO F. VARGAS Z.
TRADUCTOR E INTERPRETE OFICIAL
ESPAÑOL - INGLES - INGLES - ESPAÑOL
RES. 0001 DE ENERO 4 DE 1999
MINISTERIO DE JUSTICIA

92

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www.cavelier.com
cavelier@cavelier.com

EDIFICIO SISKI
CARRERA 4 No. 72-35
BOGOTÁ 8, COLOMBIA

Teléfono: (57-1) 347 3611
Telefax: (57-1) 211 8650
(57-1) 700 4814

Señora Jefe de la
DIVISION DE NUEVAS CREACIONES
Superintendencia de Industria y Comercio
E. S. D.

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 08-077422-00003-0000

Fecha: 2008-12-10 16:17:54 Dep 2020 NUECREACION
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Act. 444 RESPUESTA REQUE Folios: 14

Trámite : 002 Evento : 001 Actuación : 444

Referencia : Expediente No. 08077422
Asunto : Solicitud de patente para INYECCION PARA
HORNO DE VAPOR "BLACK PLANT"
Solicitante : BABCOCK & WILCOX POWER GENERATION GROUP, INC

CONTESTACION OFICIO No. 10277

1. Yo, Emilio FERRERO, en mi condición de apoderado de la sociedad solicitante, BABCOCK & WILCOX POWER GENERATION GROUP, INC, doy contestación dentro de la prórroga solicitada al requerimiento efectuado por este Despacho mediante Oficio No. 10277 notificado por fijación en lista el 14 de agosto de 2008, para lo cual presento los siguientes documentos:

1.1. Un (1) documento en que consta la cesión del derecho a la patente efectuado por los cuatro (4) inventores en favor de la sociedad BABCOCK & WILCOX POWER GENERATION GROUP, INC.

1.2. Poder otorgado por la sociedad BABCOCK & WILCOX POWER GENERATION GROUP, INC, junto con el respectivo documento que acredita la existencia y representación legal de la compañía.

2. De acuerdo con lo anterior, comedidamente solicito a Usted proseguir con el trámite de este asunto y ordenar la publicación de la solicitud de la patente identificada en la referencia.

Señora Jefe,

EMILIO FERRERO
T.P.A. No. 31.929

COLO-16645-801-001-3
SCT\SCT\ID-140142\WPC16645
No. M-2008-140142\SCT

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APOSTILLE

(Convention de La Haye du 5 octobre 1961)

1. Country: United States of America

This public document

2. has been signed by P. Swain

3. acting in the capacity of Certifying Officer

4. bears the seal/stamp of U.S. Patent and Trademark Office

Certified

5. at Washington, D.C.

6. the fourth of December, 2008

7. by Assistant Authentication Officer, United States Department of State

8. No. 09007032-1

9. Seal/Stamp:

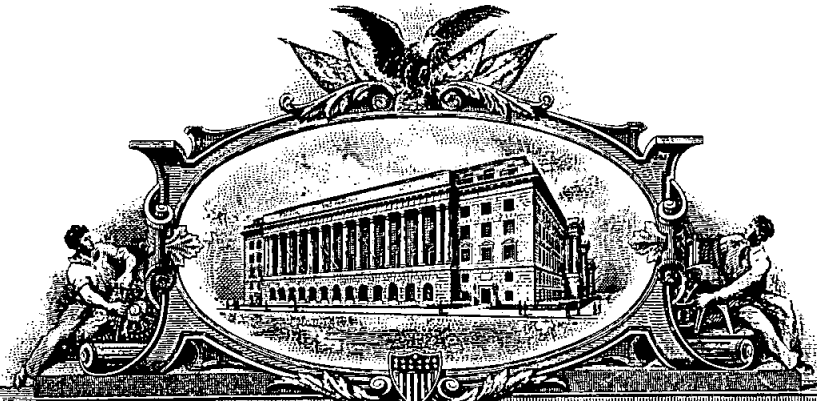
10. Signature:



Patrick O. Hatchett

2711

A 1711550



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

**UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office**

July 25, 2008

**THIS IS TO CERTIFY THAT ANNEXED IS A TRUE COPY FROM THE
RECORDS OF THIS OFFICE OF A DOCUMENT RECORDED ON
July 22, 2008.**

**By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office**

**P. SWAIN
Certifying Officer**



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PATENT ASSIGNMENT

ic Version v1.1
set Version v1.1

07/22/2008
500598843

MISSION TYPE:

NEW ASSIGNMENT

RE OF CONVEYANCE:

ASSIGNMENT

VEYING PARTY DATA

Name	Execution Date
chail Maryamchik	07/21/2008
vid J. Walker	07/21/2008
ichael J. Szmania	07/21/2008
onald L. Wietzke	07/21/2008

ECEIVING PARTY DATA

Name:	Babcock & Wilcox Power Generation Group, Inc.
Street Address:	20 S. Van Buren Avenue
City:	Barberton
State/Country:	OHIO
Postal Code:	44203

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	60952390

CORRESPONDENCE DATA

Fax Number: (330)860-6609
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 330-860-6605
Email: cmahoney@babcock.com
Correspondent Name: Carolyn Mahoney
Address Line 1: 20 S. Van Buren Avenue
Address Line 2: Intellectual Property Dept.
Address Line 4: Barberton, OHIO 44203

ATTORNEY DOCKET NUMBER:

7238

NAME OF SUBMITTER:

Carolyn Mahoney

Total Attachments: 3

CH \$40.00 60952390

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ASSIGNMENT TO BABCOCK & WILCOX POWER GENERATION GROUP, INC.

CASES 7238P and 7238

THIS ASSIGNMENT made the 21 day of July, 2008, by Mikhail Maryamchik, residing at 3800 Rosemont Boulevard #113D, Fairlawn, Ohio 44333, by Michael J. Szmania, residing at 1036 East Smith Road, Medina, Ohio 44256, by David J. Walker, residing at 185 Dawna Drive, Wadsworth, Ohio 44281, and by Donald L. Wietzke, residing at 7832 Quebrada Circle, Carlsbad, California 92009, all citizens of the United States of America;

WITNESSETH: That

WHEREAS, we are the joint inventors of a certain new and useful improvement and invention in

16645

BLACK PLANT STEAM FURNACE INJECTION

for which we have prepared and filed a United States Provisional Application for Patent on July 27, 2007 having U.S. Application Serial No. 60/952,390, and for which we have prepared and executed an application for Letters Patent of the United States on July 17, 2008 having U. S. Application Serial No. 12/175,102; and

WHEREAS, BABCOCK & WILCOX POWER GENERATION GROUP, INC., a Corporation organized under the laws of the state of Delaware, U.S.A., and having its principal office at Barberton, Ohio, U.S.A., is desirous of acquiring the entire right, title, and interest in and to said improvement and invention, the United States Provisional Application for Patent, and any and all Letters Patent which shall be granted therefor;

NOW, THEREFORE, To All Whom It May Concern, be it known that for and in consideration of the sum of One Dollar (\$1.00) to us in hand paid, and other good and valuable considerations, the receipt of which is hereby acknowledged, we, Mikhail Maryamchik, Michael J. Szmania, David J. Walker, and Donald L. Wietzke, have sold, assigned, transferred and set over, and by these presents do sell, assign, transfer and set over, unto said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors and assigns, the entire right, title, and interest in and to the above-mentioned improvement, invention, United States Provisional Application for Patent, and application for Letters Patent therefor, and in and to any and all Letters Patent of the United States which may be hereinafter be granted therefor, and in and to any and all extensions, divisions, or reissues of said Letters Patent, the same to be held and enjoyed by said BABCOCK & WILCOX POWER GENERATION GROUP, INC., for its own use and behoof, and the use and behoof of its successors and assigns, to the full

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ASSIGNMENT TO BABCOCK & WILCOX POWER GENERATION GROUP, INC.

CASES 7238P and 7238

end of the term for which said Letters Patent may be granted, as fully and entirely as the same would have been held and enjoyed by us had this assignment and sale not been made;

AND, for the consideration aforesaid, we hereby covenant and agree with said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors and assigns, that at the time of the execution and delivery of these presents, we are the joint and lawful owners of the entire right, title, and interest in and to the above-mentioned improvement, invention, United States Provisional Application for Patent, and application for Letters Patent above mentioned, and that the same are unencumbered, and that we have good right and lawful authority to sell and convey the same in the manner herein set forth;

AND, for the consideration aforesaid, we hereby covenant and agree with said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors and assigns, that we will, whenever its counsel or the counsel of its successors or assigns, learned in the law, shall advise that an amendment or division or any other proceeding in connection with said application, including interference proceedings, is lawful and desirable or that a reissue or extension of said Letters Patent is lawful and desirable, sign all papers and drawings, take all rightful oaths, and do all acts necessary or required to be done for the procurement of valid Letters Patent for said improvement and invention, or for the reissue or extension of same, without charge to said BABCOCK & WILCOX POWER GENERATION GROUP, INC., or its successors or assigns, but at its or their expense.

We hereby request the Honorable Commissioner of Patents and Trademarks of the United States to issue the Letters Patent in accordance with this instrument.

AND, for the consideration aforesaid, we have sold, assigned, transferred and set over, and by these presents do sell, assign, transfer and set over, unto said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors, assigns, or nominees, the entire right, title, and interest in and to any and all Letters Patent or other form of protection which may be granted in countries foreign to the United States, or other form of protection which may be granted and in and to any and all applications for Letters Patent or other form of protection which may be filed for said improvement and invention in countries foreign to the United States, including all rights to claim

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priority, and in and to the invention described in said applications; and we hereby authorize and empower said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors, assigns, or nominees, to apply for Letters Patent, or other form of protection, on said improvement and invention, in its own name or in the name of its successors, assigns, or nominees, in any and all countries where it may desire to file such applications and where such applications may be filed by another other than the inventors; and we hereby covenant and agree to sign all papers and drawings, take all rightful oaths, and do all acts necessary or required to be done for the procurement of valid Letters Patent, or other form of protection, for said improvement and invention in countries foreign to the United States, and for further investing or confirming the right and title thereto in said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors, assigns, or nominees, without charge to said BABCOCK & WILCOX POWER GENERATION GROUP, INC., its successors, assigns, or nominees, but at its or their expense.

Mikhail Maryamchik
Mikhail Maryamchik


Michael J. Szmania

David J. Walker
David J. Walker

Michael J. Szmania
Donald L. Wietzke
Donald L. Wietzke

WITNESSES:
Daniel L. Garrido

[Handwritten signature]

STATE OF Ohio)
) ss.
COUNTY OF Summit)

On this, the 21 day of July, 2008, before me personally appeared Mikhail Maryamchik, Michael J. Szmania, David J. Walker, and Donald L. Wietzke to me known and known to me to be the persons described in and who executed the foregoing instrument; and they acknowledged to me that they executed the same for the purpose therein stated.

Natalie's friends

Page 3 of 3

NATALEIGH LASRADO
RESIDENT MEDINA COUNTY
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES JULY 25, 2009

RECORDED: 07/22/2008

REEL 021269 FRAME 0527

CAVELIER

ABOGADOS

EDIFICIO SISKI
CARRERA 4a N° 72-35
BOGOTÁ, 8 - COLOMBIA

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Representación y Poder con autenticación notarial y Apostille para patentes, modelos de utilidad, diseños industriales, marcas de fábrica, nombres comerciales, enseññas, nombres de dominio, lemas comerciales, licencias.

Representation and Power-of-Attorney with notarial authentication and Apostille for patents, utility models, industrial designs, trademarks, commercial names, trade emblems, domain names, slogans, licenses.

REPRESENTACION Y PODER

REPRESENTATION AND POWER-OF-ATTORNEY

Yo (nosotros), abajo firmado (s)/I (we), the undersigned

BABCOCK & WILCOX POWER GENERATION GROUP, INC.

domiciliado (s) en/of : 20 S. VAN BUREN AVENUE, BARBERTON, OHIO 44203-0351, US

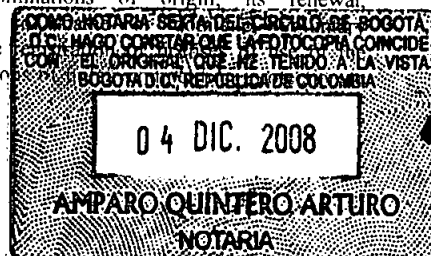
hereby ratify the patent application No. 08077422 filed by Emilio Ferrero on July 25, 2008

por el presente nombramos a EMILIO FERRERO, tpa. 31929; LUZ CLEMENCIA DE PAEZ, tpa. 23555 y DANIEL PEÑA, tpa. 65.620, domiciliados en la Carrera 4a N° 72-35, Bogotá, Colombia, en obediencia a lo dispuesto en el parágrafo 1o del Artículo 543 del Código de Comercio, el primero como principal y los demás como suplentes, en su orden, como mis (nuestros) representantes en todos los asuntos de propiedad industrial con facultad para recibir notificaciones y nombrar apoderados judiciales o extrajudiciales. El primer representante suplente reemplazará al principal en caso de ausencia o impedimento temporal o definitivo de aquél. La misma regla se aplicará cuando el segundo representante suplente haya de reemplazar al primero, o el tercero al segundo. En tales casos, el representante principal, o el primero, o segundo suplente, en su caso, o ambos, declararán su intención de no ejercer la representación mediante declaración autenticada por Notario Público en Colombia, o por Notario u otro Funcionario Público, o Cónsul de Colombia, en el extranjero; y si se tratare de impedimento, con el certificado respectivo. Si alguno de los nombrados faltare definitivamente, el siguiente tomará su lugar. Cuando cesare la ausencia o impedimento del representante principal, o de su primero o segundo suplentes, en su caso, podrán ejercer la representación, en su orden, uno u otros según el caso, asumiéndola por el solo hecho de ejercerla, cesando en ese momento el ejercicio de la representación por el primero, segundo o tercer suplente en su caso.

Además, confiero (conferimos) poder a los abogados arriba nombrados, para obtener la protección de mi (nuestra) propiedad industrial y contra la competencia desleal, a cuyo efecto autorizo (amos) a los dichos apoderados para que me (nos) representen ante cualesquiera entidades o personas, ejerzan o no jurisdicción, especialmente ante las del orden administrativo, contencioso-administrativo y judicial, así como los tribunales de arbitramento, en todo lo concerniente a los siguientes asuntos: a) Obtención de patentes de invención, modelos de utilidad y diseños industriales; el registro de marcas de fábrica, colectivas, defensivas, de servicio, lemas comerciales, nombres comerciales, enseññas, nombres de dominio, variedades vegetales y denominaciones de origen; su renovación, traspaso, cambio de nombre o domicilio, cancelación voluntaria; y el registro de licencias de uso de esos derechos; b) Las acciones de

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WPP0001-181

in due compliance with the terms of paragraph 1st. of article 543 of the Commercial Code, do hereby appoint EMILIO FERRERO, tpa. 31929; LUZ CLEMENCIA DE PAEZ, tpa. 23555 and DANIEL PEÑA, tpa. 65620, domiciled at Carrera 4a N° 72-35, Bogotá, Colombia, the first as principal and the others as alternates, in the order of their appointment, as our representatives for all industrial property matters with faculty to receive notifications and to appoint attorneys in and out of Court. The first alternate shall replace the principal in case of his absence or of temporal or definitive impediment. The same rule will apply when the second alternate representative is to replace the first one, or when the third is to replace the first or second alternates in their turn, or both of them, second. In such cases, the principal representative, or the first or second alternates in their turn, or both of them, shall state their intention not to act as representatives through a declaration given before a Notary Public in Colombia, or before a Notary or another Public Official or a Colombian Consul abroad; and in case of impediment, the appropriate certificate shall suffice. If any of the appointees were to be definitely absent, the following alternate shall take his place. When the absence or impediment of the principal representative, or of the first or second alternate in their turn ceases, the representation can be taken again in their sequence, by the principal, the first or second alternate depending on case, and the mere fact or its exercise will suffice. The exercise of the representation by the first, second or third alternates in their turn shall end at such time. In addition, we grant a Power of Attorney in favor of the above-named attorneys-at-law so that they may obtain the protection of my (our) industrial property and against the unfair competition, for which purpose I (we) authorize the said attorneys to represent me (us) before any authorities or persons, with or without jurisdiction, specially those administrative, administrative contentious and judicial, as well as before Arbitration Court, in all matters concerning the following: a) Obtainment of patents, utility models and industrial designs; the registration of trademarks, collective, defensive and service marks, slogans, commercial names, trade emblems, domain names, vegetal varieties and denominations of origin; its renewal assignment, change of name or domicile, voluntary cancellation; and the above rights; b) Action

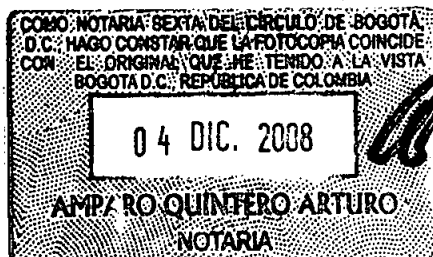


competencia desleal, protección del consumidor, oposiciones u observaciones, cancelación administrativa y judicial, nulidad, medidas cautelares, concesión de licencias, la tutela, la protección de secretos industriales, y en general los juicios civiles, penales, administrativos o contencioso administrativos relacionados con estos derechos; acciones y procesos que promovamos o se nos promuevan. Y para que en todos los asuntos arriba determinados, puedan sustituir este mandato, transigir, conciliar, admitir los hechos del proceso, desistir, cancelar, recibir, renunciar, y ratificar los actos de agentes oficiosos, the consumer, oppositions or observations, administrative or Court cancellation, nullity, infringement, granting of licenses, the action for writ mandamus, the protection of trade secrets, and in general the civil, penal, and administrative suits relating to those rights; actions and suits instituted by me (us) or against me (us). And that in all the above matters they may substitute this Power of Attorney, compromise, conciliate, admit the facts of the case, desist, cancel, receive, resign, and ratify acts done by representatives without a power of attorney.

Dado y firmado hoy/Given and signed this NOVEMBER 12, 2008
en/in BARBERTON, OHIO, US

por/by ERIC MARICH, MANAGING ATTORNEY - INTELLECTUAL PROPERTY
ATTORNEY-IN-FACT

Firma/Signature Eric Marich



CERTIFICACIÓN NOTARIAL (INDIVIDUO)

A los _____ días del mes _____
de _____ ante mí, Notario Público o Funcionario
200 _____ Autorizado de _____

compareció(eron)
personalmente _____

a quien(es) doy fe de conocer y me consta que es(son) la(s)
persona(s) firmante(s) del documento que precede, y
quien(es) tiene(n) capacidad legal para otorgarlo

--- NOTARIO PÚBLICO O FUNCIONARIO AUTORIZADO --- NOTARY PUBLIC OR ATTESTING OFFICIAL ---

CERTIFICACIÓN NOTARIAL (SOCIEDAD)

A los 12 días del mes Noviembre
de _____
200 8 compareció(eron) ante mí,
ERIC MARICH

Quien(es) conozco personalmente y que firma(n) este
documento en representación de la Sociedad/compañía
denominada

BABCOCK & WILCOX POWER GENERATION GROUP, INC.

Certifico:

1. Que he visto los siguientes documentos:*

Artículos de Constitución, 11/20/2007,
Delaware, Estatutos, 11/20/2007, Delaware,
Consentimiento unánime, 7/26/2007, Delaware

2. Que dichos documentos prueban lo siguiente:

2.1. Que **BABCOCK & WILCOX POWER GENERATION
GROUP, INC.** es una Sociedad/Compañía
legalmente constituida y existente de acuerdo con las leyes
del Estado de

2.2. Que el domicilio de dicha Sociedad/Compañía es
BARBERTON, OHIO, EUA

2.3. Que el objeto u objetos para los cuales se otorga el
presente poder están comprendidos dentro del objeto social
de la mencionada Sociedad/Compañía.

2.4. Que el(los) ERIC MARICH
Sr.(Sres.)

está(n) autorizado(s) para otorgar el presente Poder.

Ciudad BARBERTON
Estado OHIO
Hoy 12 Noviembre de 2008

--- NOTARIO PÚBLICO O FUNCIONARIO AUTORIZADO --- NOTARY PUBLIC OR ATTESTING OFFICIAL ---

* Los documentos deben identificarse con fecha y origen



MICHAEL J. SEYMOUR
NOTARY PUBLIC - OHIO
MY COMMISSION HAS NO EXPIRATION DATE
UNDER SECTION 147.03 R.C.

NOTARIAL CERTIFICATION (INDIVIDUAL)

On this _____ day of _____

200 _____ before me, a Notary Public or Attesting Official of _____

personally
appeared _____

to me known, and known to me to be the person(s) who
executed that foregoing document, and who has(have) legal
capacity to execute it.

NOTARIAL CERTIFICATION (CORPORATION)

On this 12TH day of NOVEMBER

200 8 appeared before me

ERIC MARICH

who(m) I know personally and who(m) signed this
document as representative(s) of the Corporation/Company
named **BABCOCK & WILCOX POWER GENERATION GROUP, INC.**

I certify:

1. That I have seen the following documents:*

Certificate of Incorporation, 11/20/2007, Delaware
By-laws, 11/20/2007, Delaware
Unanimous Consent, 7/26/2007, Delaware

2. That the above documents duly prove the following:

BABCOCK & WILCOX POWER GENERATION GROUP, INC.

2.1. That **BABCOCK & WILCOX POWER GENERATION GROUP, INC.** is a Corporation/Company legally

constituted and in existence in accordance with the laws of
the State of **DELAWARE**

2.2. That the domicile of said Corporation/Company is
BARBERTON, OHIO, US

2.3. That the purpose or purposes for which the present
Power of Attorney is granted are comprised within the
corporate purposes set forth in the charter of the
mentioned Corporation/Company.

2.4. That
Mr.(Messrs.) ERIC MARICH

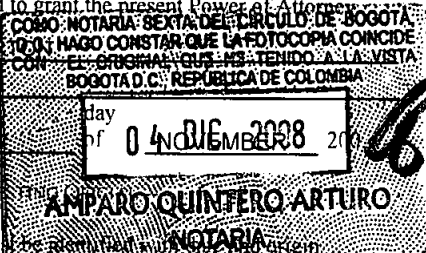
is(are) authorized to grant the present Power of Attorney

City BARBERTON
State OHIO

This 12TH day of NOVEMBER 2008

--- NOTARIO PÚBLICO O FUNCIONARIO AUTORIZADO --- NOTARY PUBLIC OR ATTESTING OFFICIAL ---

* Documents must be identified with date and origin



El Notario Publico The Notary Public
(Firma-sello) (Signature-seal)

APOSTILLE

(Convention de la Haye du 5 octobre 1961)

1. Country: United States of America

This public document

2. has been signed by MICHAEL J. SEYMOUR

3. acting in the capacity of Attorney at Law, Notary Public, State of Ohio

4. bears the seal/stamp of Notary Public, State of Ohio

CERTIFIED

5. at Columbus, Ohio

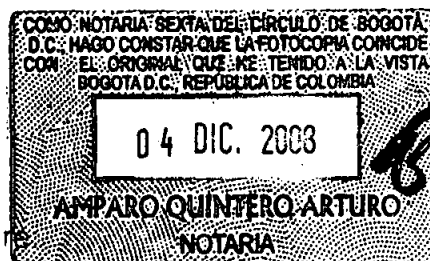
6. November 13, 2008

7. by the Secretary of State of Ohio.

8. No. 017378

9. Seal/Stamp:

10. Signature



Jennifer Brunner

Jennifer Brunner
Secretary of State of Ohio

This certification certifies only the authenticity of the signature of the official who signed the document, the capacity in which that official acted, and where appropriate, the identity of the seal or stamp which the document bears. This certification does not imply that the contents of the document(s) are correct, nor that they have the approval of this office.

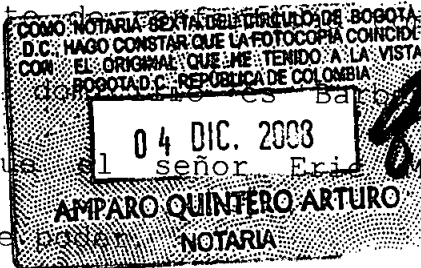
TRADUCCIÓN OFICIAL No. 12.02/08a realizada por Diego Vargas, Traductor Oficial, Resolución No. 0001 de 1999 del Ministerio de Justicia, registrado ante el Ministerio de Relaciones Exteriores de Colombia.

A continuación se traducen los sellos y legalizaciones de un documento mediante el cual **BABCOCK & WILCOX POWER GENERATION GROUP, INC.**, domiciliada en 20 S. Van Buren Avenue, Barberton, Ohio 44203-0351, Estados Unidos de América, por el presente ratifica la solicitud de patente No. 08077422 presentada por el Doctor Emilio Ferrero el 25 de julio de 2008 y adicionalmente otorga derechos de representación y poder a los Doctores Emilio Ferrero, tpa. 31929; Luz Clemencia de Páez, 23555 y Daniel Peña, tpa. 65620, domiciliados en la Carrera 4 No. 72-35, Bogotá, Colombia.

Dado y firmado el 12 de noviembre de 2008 en Barberton, Ohio, Estados Unidos por Eric Marich, Abogado Ejecutivo - Apoderado de Propiedad Intelectual.

Firma Firma Ilegible

CERTIFICACIÓN NOTARIAL (SOCIEDAD) por medio de la cual se certifica la firma del señor Eric Marich en el anterior documento en representación de BABCOCK & WILCOX POWER GENERATION GROUP, INC. y adicionalmente se certifica que la anterior es una sociedad debidamente constituida y existente de acuerdo a las leyes del Estado de Delaware, que su domicilio es Barberton, Ohio, Estados Unidos de América y que el señor Eric Marich está autorizado para otorgar el presente poder.



Dado y firmado en la ciudad de Barberton, Estado de Ohio el 12 de noviembre de 2008.

MICHAEL J. SEYMUR
NOTARIO PÚBLICO - OHIO
MÍ COMISIÓN NO TIENE FECHA DE VENCIMIENTO
DE CONFORMIDAD CON EL ARTÍCULO 147.03 R.C.

Diego F. Vargas
DIEGO F. VARGAS

TRADUCTOR E INTERPRETE OFICIAL
Firma Ilegible
El Notario Público
RES. 0001 DE ENERO 4 DE 1999
MINISTERIO DE JUSTICIA

APOSTILLA

(Convention de La Haye du 5 octobre 1961)

1. País: Estados Unidos de América
Este documento público
2. ha sido firmado por MICHAEL J. SEYMOUR
3. actuando en calidad de Abogado, Notario Público, Estado de Ohio
4. lleva el sello/estampilla de Notario Público, Estado de Ohio

CERTIFICADO

5. en Columbus, Ohio
6. El 13 de Noviembre de 2007
7. por el Secretario de Estado de Ohio.
8. No. 017378 ✓
9. Sello/estampilla
10. Firma:



Firma ilegible

Jennifer Brunner
Secretario del Estado de Ohio

Esta certificación certifica solo la autenticidad de la firma del funcionario que firmó el documento, la capacidad en la cual actuó dicho funcionario y si fuera adecuado, la identidad del sello o estampilla que lleva el documento. Esta certificación no implica que el contenido del documento(s) es correcto ni que cuentan con la probación de esta oficina.

Esta certificación es una copia y completa de la cual se deja copia en esta oficina para su confrontación.

DVZ\DVZ\84-239466\WPCL002H\COLO 16645-801-001-3

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RESPONSABILIDAD
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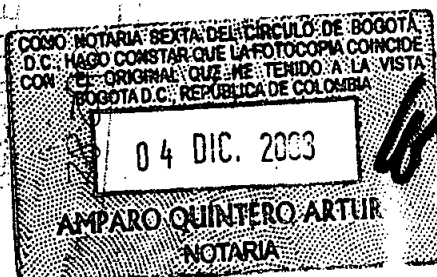
84-239466
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DOCUMENTO DE EMPEÑO
ASIGNACIONES INDICADAS

MINISTERIO DE
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2008 DIC -3 A 11:05

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BOGOTA D.C.

MINISTERIO DE RELACIONES EXTERIORES
RECIBO DE LEGALIZACION



DIEGO F. VARGAS Z.
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