

37

As. 108.102

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 08-079801- -00002-0000

Fecha: 2008-10-28 16:46:05 Dep. 2020 NUECREACION
Tra 2 PATENTES Eve: 1 REGDEPOSITO
Act. 444 RESPUESTAREQUE Folios: 78

Señores

**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISION DE NUEVAS CREACIONES**

E. S. D.

RESPUESTA A OFICIO 10824 DEL 28 AGOSTO 2008

REF: Expediente No. 08 079801 - Solicitud de Patente
a favor de **UOP LLC**

Titulada: PROCESO Y APARATO PARA RECUPERAR ENERGÍA DE UN
PRODUCTO FCC

JUAN PABLO CADENA SARMIENTO, vecino de Bogotá, portador de la tarjeta profesional No. 57492, obrando como apoderado de la sociedad **UOP LLC**, según lo acredita el documento de poder presentado en esa División, para dar cumplimiento al requerimiento notificado por fijación en lista el 28 de agosto de 2008, de acuerdo con los Artículos 38 y 39 de la Decisión 486 de la Comisión de la Comunidad Andina, me permito allegar:

1. Documentos (2) donde consta la cesión del derecho a la Patente otorgado por los inventores al solicitante, debidamente apostillados, junto con sus correspondientes traducciones al castellano.
2. Copias certificadas por la Oficina de Patentes de Estados Unidos de las dos primeras solicitudes presentadas para la misma invención, de las cuales REIVINDICAMOS PRIORIDAD, junto con sus correspondientes traducciones al castellano.
3. Artes finales (2 de 12 cm X 12 cm y 1 de 6 cm X 6 cm).
4. Extracto para publicación y Tarjeta de archivo Temático.

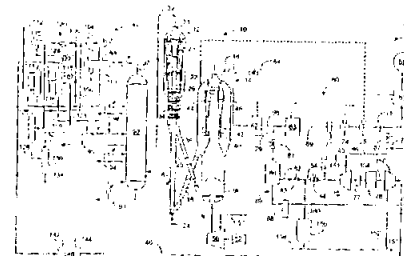
De la señora Jefe atentamente,


JUAN PABLO CADENA SARMIENTO
C.C. No. 80.410.337 de Usaquén
Cra 7 No. 71-21, Torre B, Piso 4

Bogotá, 27 de octubre de 2008
MEVCAG/aac

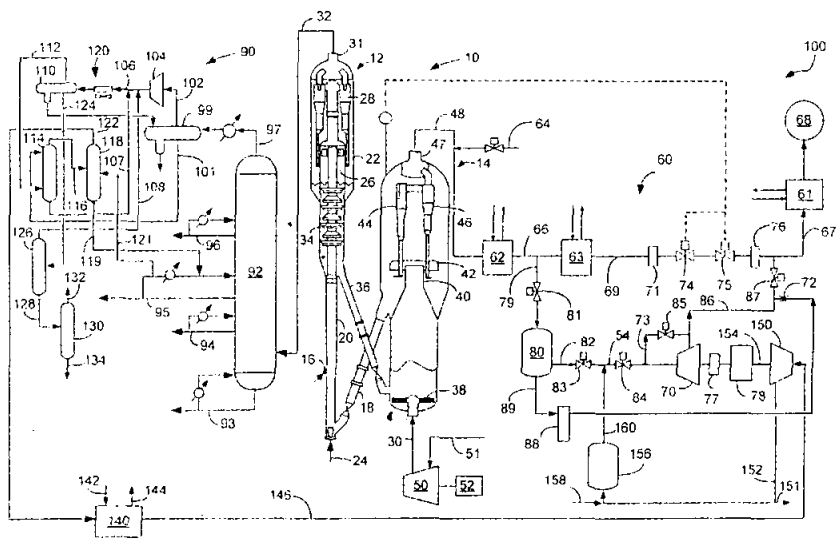
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO DIVISION DE NUEVAS CREACIONES TARJETA ARCHIVO TEMÁTICO	
Industria y Comercio SUPERINTENDENCIA	PATENTE DE INVENCION ☒ PCT ☐ MODELO DE UTILIDAD ☐ DISEÑO INDUSTRIAL ☐

(21) N° de solicitud: 08 079801	(22) Fecha de solicitud: 31-07-2008					
(541) Clasificación Internacional:						
(71) Solicitante(s): UOP LLC						
(72) Inventor(es): Xin Xiong Zhu, Keith Allen Couch, James Patrick Glavin						
(74) Agente: JUAN PABLO CADENA SARMIENTO						
(30) Prioridad	(31)	No. Prioridad	(32)	Fecha	(33)	País
		11/832,136		01-08-2007		US
		11/832,143		01-08-2007		US
(85) Fecha inicio fase nacional:				(87) Publicación internacional:		
(86) Datos relativos a la presentación de la solíc. PCT				Fecha:		
Fecha de presentación de la solicitud:				No. Publicación :		
No. de solicitud						



(54) Título: PROCESO Y APARATO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC
(57) 1. Un proceso para procesar corrientes provenientes de una unidad de craqueo catalítico tipo fluido, el cual comprende: - contactar el catalizador de craqueo con una corriente de carga de hidrocarburos para craquear los hidrocarburos en productos hidrocarburos gaseosos con un peso molecular menor y depositar coque en el catalizador para proporcionar catalizador coquizado; - separar el citado catalizador coquizado de los citados productos hidrocarburos gaseosos; - agregar oxígeno al citado catalizador coquizado; - quemar coque en el citado catalizador coquizado con oxígeno para regenerar el citado catalizador y proporcionar gas de chimenea; - separar el citado catalizador del citado gas de chimenea para proporcionar una corriente de gas de chimenea; - separar los citados productos hidrocarburos gaseosos para obtener una pluralidad de corrientes de producto, incluida una corriente de producto seleccionado; y - combinar por lo menos una porción de la citada corriente de producto seleccionado con por lo menos una porción de la citada corriente de gas de regeneración para proporcionar una corriente combinada.
CONTINUA AL RESPALDO ...

7. Un aparato para procesar corrientes de una unidad de craqueo catalítico tipo fluido, el cual comprende:
- un reactor de craqueo catalítico tipo fluido para contactar catalizador de craqueo con una corriente de carga de hidrocarburos para craquear los hidrocarburos en productos hidrocarburos gaseosos que tienen un peso molecular menor y depositar coque en el catalizador para proporcionar catalizador coquizado;
 - una salida de producto para descargar los citados productos hidrocarburos gaseosos del citado reactor;
 - un regenerador para quemar coque del citado catalizador coquizado por contacto con oxígeno;
 - una salida de gas de chimenea para descargar gas de chimenea del citado regenerador;
 - una sección de recuperación de producto en comunicación corriente abajo con la citada salida de producto, siendo la citada sección de recuperación de producto para separar los citados productos gaseosos en una pluralidad de corrientes de producto, incluida una corriente de producto seleccionado;
 - una sección de recuperación de energía en comunicación corriente abajo con la citada salida de gas de chimenea; y
 - estando la citada sección de recuperación de energía en comunicación corriente abajo con la citada sección de recuperación de producto.



Arfe final
12 x 12cm

AS:108102(1)



SPRINGFIELD, ILLINOIS

APOSTILLE

(Convention de La Haye du 5 Octobre 1961)

1. Country: United States of America
This public document
2. has been signed by ROSE A. NAGEL
3. acting in the capacity of NOTARY PUBLIC, MCHENRY COUNTY
4. bears the seal/stamp of STATE OF ILLINOIS

Certified

5. Springfield, Illinois
6. AUGUST 8, 2008
7. by the Secretary of State, State of Illinois
8. No. S08KL15065
9. Seal/Stamp:
10. Signature:



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS

UOP LLC
(a Delaware limited liability company)

Certificate of Assistant Secretary

I, Frank S. Molinaro, do hereby certify that I am a duly elected Assistant Secretary – Patent Matters of UOP LLC, a limited liability company of Delaware, United States of America and that:

1) the attached is a true copy of the fully executed Assignment dated October 10, 2007, October 15, 2007, and October 11, 2007 whereby;

Xin X. ZHU
Keith A. COUCH
James P. GLAVIN

inventors of an invention entitled:

PROCESS FOR RECOVERING POWER FROM FCC PRODUCT

assigned their worldwide interest in said invention, and in an application for Letters Patent of the United States of America for said invention, including all foreign rights to said invention, to UOP LLC, a limited liability company, organized under the laws of the State of Delaware, United States of America, and having its principal office at Des Plaines, Illinois, United States of America;

2) that an application for Letters Patent for said invention was filed in the United States of America Patent Office under Application No. 11/832,136 on August 1, 2007;

3) that the invention so assigned is the same as the invention in respect of which an application for Letters Patent in **COLOMBIA** has been entitled:

PROCESS FOR RECOVERING POWER FROM FCC PRODUCT

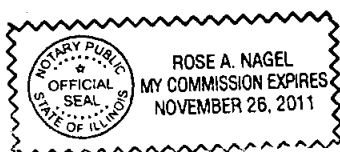
IN WITNESS WHEREOF, I have executed this certificate on behalf of UOP LLC on July 28, 2008.

Frank S. Molinaro

Frank S. Molinaro
Assistant Secretary – Patent Matters

NOTARY ACKNOWLEDGEMENT

This instrument was acknowledged before me in McHenry County, Illinois, U.S.A., on July 28, 2008, by Frank S. Molinaro, Assistant Secretary - Patent Matters of UOP LLC, a limited liability company of Delaware, United States of America.



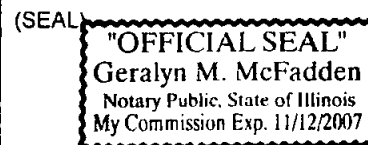
Rose A. Nagel
Notary Public

ASSIGNMENT

WHEREAS, XIN X. ZHU, a citizen of the United Kingdom, residing in Long Grove, Illinois; KEITH A. COUCH, a citizen of the United States of America, residing in Arlington Heights, Illinois; and JAMES P. GLAVIN, a citizen of the United States of America, residing in Naperville, Illinois; and hereinafter referred to as "the inventors" have invented certain new and useful improvements in **PROCESS FOR RECOVERING POWER FROM FC PRODUCT**. WHEREAS, the inventors hereby authorize and request their attorney/agent of record to have inserted on each page (where indicated below) the filing date and application number of said application when known; and WHEREAS, UOP LLC, a company organized and existing under the laws of the State of Delaware having a principal place of business at Des Plaines, Illinois, is desirous of acquiring an interest in and to said application, the inventions disclosed therein, any corresponding foreign patent application disclosing the same invention and the Letters Patents of the United States and foreign countries that may be issued thereon. NOW, THEREFORE, for good and valuable consideration, the receipt of which is hereby acknowledged, the inventors do hereby transfer, set over and assign unto UOP LLC, its successors and assigns, the entire right, title and interest in, to and under said application; the invention(s) covered thereby; any and all resultant patent or patents thereon; any renewals, reissues, extensions, reexaminations, substitutions, continuations, or divisions thereof, and all foreign rights thereunder including all rights to claim any priority in and to the inventions disclosed therein. Inventors hereby authorize and request the Commissioner of Patents and Trademarks to issue said Letters Patent to said UOP LLC, its successors and assigns. IN WITNESS WHEREOF, the inventors have set their signatures hereunto on the date specified below.

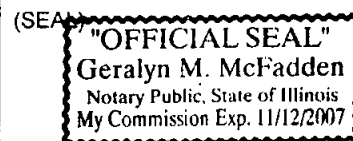
Xin X. Zhu
Xin X. Zhu
10/10/07
Date

State of Illinois; County of Cook
This instrument was acknowledged before me on this 10th
day of October, 2007, by Xin X. Zhu.
Geralyn M. McFadden
Notary Public



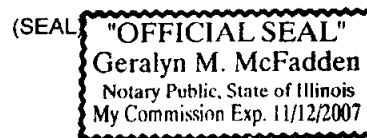
Keith A. Couch
Keith A. Couch
10/15/07
Date

State of Illinois; County of Cook
This instrument was acknowledged before me on this 15th
day of October, 2007, by Keith A. Couch.
Geralyn M. McFadden
Notary Public



James P. Glavin
James P. Glavin
10/11/07
Date

State of Illinois; County of Cook
This instrument was acknowledged before me on this 11th
day of October, 2007, by James P. Glavin.
Geralyn M. McFadden
Notary Public



6

TRADUCCION AL ESPAÑOL del Documento de Cesión a **UOP LLC** firmado por los cedentes y el cesionario.

APOSTILLA

(Convención de La Haya del 5 de Julio de 1961)

1. PAÍS: ESTADOS UNIDOS DE AMÉRICA
ESTE DOCUMENTO PÚBLICO
2. HA SIDO FIRMADO POR ROSE A. NAGEL
3. ACTUANDO EN CAPACIDAD DE NOTARIO PÚBLICO, CONDADO MCHENRY
4. LLEVA EL SELLO/TIMBRE DEL ESTADO DE ILLINOIS

CERTIFICADO

- | | |
|--|-------------------|
| 5. SPRINGFIELD, ILLINOIS | 6. AGOSTO 8, 2008 |
| 7. POR EL SECRETARIO DE ESTADO, ESTADO DE ILLINOIS | |
| 8. NO. S08KL15065 | |
| 9. SELLO/TIMBRE | 10. FIRMA |

(FIRMA)

JESSE WHITE
SECRETARIO DE ESTADO
ESTADO DE ILLINOIS

Hay un sello que dice:

SELLO DEL ESTADO DE ILLINOIS – AGOSTO 26 DE 1818

UOP LLC
(una compañía de responsabilidad limitada de Deleware)

Certificado del Secretario Asistente

Yo, Frank S. Molinaro, certifico que soy un Secretario Asistente debidamente certificado – Asuntos de Patentes de UOP LLC, una compañía de responsabilidad limitada de Delaware, Estados Unidos de América y que:

- 1) El anexo es una copia verdadera de la cesión plenamente perfeccionada fechada el 10 de octubre de 2007, el 15 de octubre de 2007 y el 11 de octubre de 2007, donde;

Xin X. ZHU
Keith A. COUCH
James P. GLAVIN

Inventores de la invención titulada:

PROCESO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC

cedieron su interés mundial en tal invención, así como el presentar solicitudes de patente en Estados Unidos de América para dicha invención, incluyendo los derechos en el extranjero para tal invención, a UOP LLC, una compañía de responsabilidad limitada, organizada bajo las leyes del Estado de Delaware, Estados Unidos de América, y teniendo su oficina principal en Des Plaines, Illinois, Estados Unidos de América;

- 2) que una solicitud para la patente de dicha invención fue presentada en la Oficina de Patentes de los Estados Unidos de América según expediente N° 11/832,136, el 1 de agosto de 2007;
- 3) que la invención así cedida es la misma que la invención respecto de la cual una solicitud para patente en Colombia ha sido titulada:

PROCESO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC

COMO TESTIGO, yo he ejecutado este certificado en nombre de UOP LLC, el 28 de julio de 2008.

Firma _____
Frank S. Molinaro
Secretario Asistente – Asuntos de Patentes

RECONOCIMIENTO NOTARIAL

Este instrumento fue reconocido ante mí en el Condado de McHenry, Illinois, EE. UU., el 28 de julio de 2008, por Frank S. Molinaro, Secretario Asistente – Asuntos de Patentes de UOP LLC, una compañía de responsabilidad limitada de Delaware, Estados Unidos de América.

Firma _____
Notario Público

Hay un sello que dice: Sello oficial. Notario Público – Estado de Illinois. Rose A. Nagel. Mi encargo vence: el 26 de noviembre de 2011.

2

CESIÓN

Asunto legal N° UOP27704-04

CONSIDERANDO QUE, **XIN X. ZHU**, ciudadano del Reino Unido, residente en Long Grove, Illinois; **KEITH A. COUCH**, ciudadano de los Estados Unidos de América, residente en Arlington Heights, Illinois; y **JAMES P GLAVIN**, ciudadano de los Estados Unidos de América, residente en Naperville, Illinois de aquí en adelante considerados como "los inventores", han inventado ciertos mejoramientos útiles y nuevos en **PROCESO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC**. CONSIDERANDO QUE los inventores aquí autorizan y requieren que su abogado/agente del expediente el haber insertado en cada página (donde se indica más abajo) la fecha de presentación y el número de la solicitud de dicha presentación cuando se sepa; y CONSIDERANDO QUE UOP LLC, una compañía organizada y existente según las leyes del Estado de Delaware y cuyo principal lugar de negocios es Des Plaines, Illinois, desea adquirir un interés en y para dicha solicitud, donde se divulgaron las invenciones, y las patentes de los Estados Unidos que pueden ser concedidas. AHORA, POR TANTO, por buena y valiosa contraprestación, cuyo recibo aquí se reconoce, dichos inventores efectivamente transfieren y ceden a la mencionada UOP LLC, sus sucesores y asignatarios, el derecho total, el título y el interés en, para y bajo tal solicitud; la invención protegida; cualquiera y todas las patentes resultantes a partir de ahí; cualquier renovación, republicación, extensiones, re-exámenes, sustituciones, continuaciones, o divisiones a partir de ahí y todos los derechos extranjeros derivados, incluyendo todos los derechos a reclamar prioridad en y a las invenciones divulgadas a partir de ahí. Los inventores autorizan y solicitan al Comisionado de Patentes y Marcas a expedir dichas patentes a la mencionada UOP LLC, sus sucesores y asignatarios. COMO TESTIGOS DE LO ANTERIOR, los inventores han puesto sus firmas abajo en la fecha especificada abajo.

Firma	10/10/07
Xin X. Zhu	Fecha

Estado de Illinois
Condado de Cook

Este instrumento fue reconocido ante mí este 10 de octubre de 2007, por **Xin X. Zhu**.

Firma _____
Notario Público

(SELLO) Hay un sello que dice:

"SELLO OFICIAL"
Geraldyn M. Mc Fadden
Notario Público, Estado de Illinois
Mi encargo expira el 12/11/2007

Firma
Keith A. Couch

15/10/07
Fecha

Estado de Illinois
Condado de Cook

Este instrumento fue reconocido ante mí este 15 de octubre de 2007, por **Keith A. Couch**.

Firma
Notario Público

(SELLO) Hay un sello que dice:

"SELLO OFICIAL"
Geraldyn M. Mc Fadden
Notario Público, Estado de Illinois
Mi encargo expira el 12/11/2007

Firma
James P. Glavin

11/10/07
Fecha

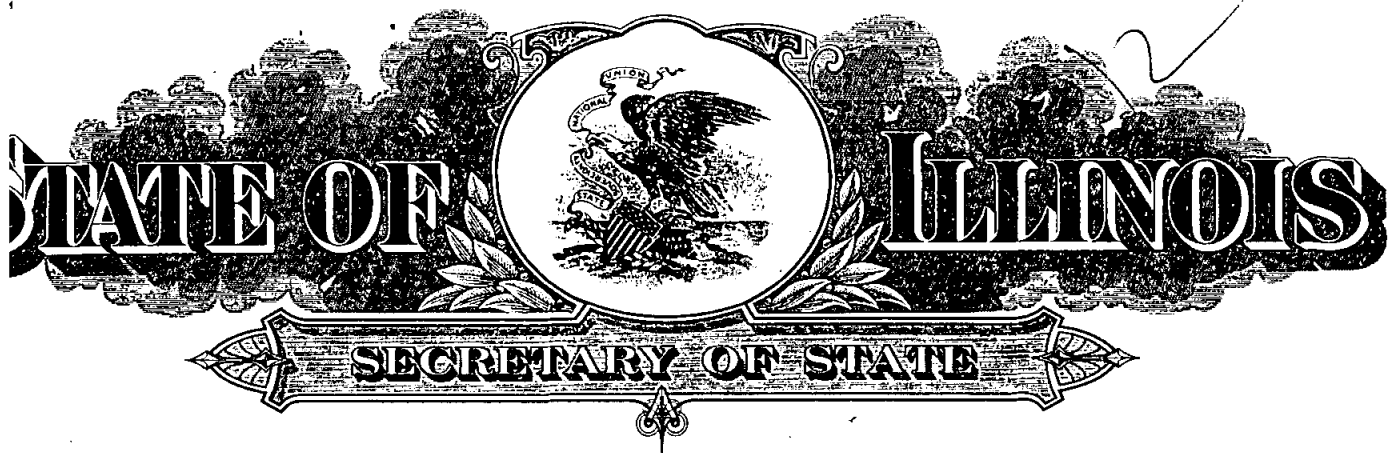
Estado de Illinois
Condado de Cook

Este instrumento fue reconocido ante mí este 11 de octubre de 2007, por **James P. Glavin**.

Firma
Notario Público

(SELLO) Hay un sello que dice:

"SELLO OFICIAL"
Geraldyn M. Mc Fadden
Notario Público, Estado de Illinois
Mi encargo expira el 12/11/2007



SPRINGFIELD, ILLINOIS

APOSTILLE

(Convention de La Haye du 5 Octobre 1961)

1. Country: United States of America
This public document
2. has been signed by ROSE A. NAGEL
3. acting in the capacity of NOTARY PUBLIC, MCHENRY COUNTY
4. bears the seal/stamp of STATE OF ILLINOIS

Certified

5. Springfield, Illinois
6. AUGUST 8, 2008
7. by the Secretary of State, State of Illinois
8. No. S08KL15064
9. Seal/Stamp:
10. Signature:

Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS



UOP LLC
(a Delaware limited liability company)

Certificate of Assistant Secretary

I, Frank S. Molinaro, do hereby certify that I am a duly elected Assistant Secretary – Patent Matters of UOP LLC, a limited liability company of Delaware, United States of America and that:

1) the attached is a true copy of the fully executed Assignment dated October 10, 2007, October 15, 2007, and October 11, 2007 whereby;

Xin X. ZHU
Keith A. COUCH
James P. GLAVIN

inventors of an invention entitled:

APPARATUS FOR RECOVERING POWER FROM FCC PRODUCT

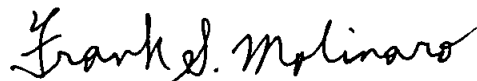
assigned their worldwide interest in said invention, and in an application for Letters Patent of the United States of America for said invention, including all foreign rights to said invention, to UOP LLC, a limited liability company, organized under the laws of the State of Delaware, United States of America, and having its principal office at Des Plaines, Illinois, United States of America;

2) that an application for Letters Patent for said invention was filed in the United States of America Patent Office under Application No. 11/832,143 on August 1, 2007;

3) that the invention so assigned is the same as the invention in respect of which an application for Letters Patent in **COLOMBIA** has been entitled:

APPARATUS FOR RECOVERING POWER FROM FCC PRODUCT

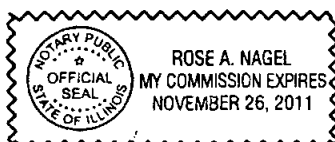
IN WITNESS WHEREOF, I have executed this certificate on behalf of UOP LLC on July 28, 2008.



Frank S. Molinaro
Assistant Secretary – Patent Matters

NOTARY ACKNOWLEDGEMENT

This instrument was acknowledged before me in McHenry County, Illinois, U.S.A., on July 28, 2008, by Frank S. Molinaro, Assistant Secretary - Patent Matters of UOP LLC, a limited liability company of Delaware, United States of America.


Notary Public

WHEREAS, XIN X. ZHU, a citizen of the United Kingdom, residing in Long Grove, Illinois; KEITH A. COUCH, a citizen of the United States of America, residing in Arlington Heights, Illinois; and JAMES P. GLAVIN, a citizen of the United States of America, residing in Naperville, Illinois; and hereinafter referred to as "the inventors" have invented certain new and useful improvements in **APPARATUS FOR RECOVERING POWER FROM FCC PRODUCT**. WHEREAS, the inventors hereby authorize and request their attorney/agent of record to have inserted on each page (where indicated below) the filing date and application number of said application when known; and WHEREAS, UOP LLC, a company organized and existing under the laws of the State of Delaware having a principal place of business at Des Plaines, Illinois, is desirous of acquiring an interest in and to said application, the inventions disclosed therein, any corresponding foreign patent application disclosing the same invention and the Letters Patents of the United States and foreign countries that may be issued thereon. NOW, THEREFORE, for good and valuable consideration, the receipt of which is hereby acknowledged, the inventors do hereby transfer, set over and assign unto UOP LLC, its successors and assigns, the entire right, title and interest in, to and under said application; the invention(s) covered thereby; any and all resultant patent or patents thereon; any renewals, reissues, extensions, reexaminations, substitutions, continuations, or divisions thereof, and all foreign rights thereunder including all rights to claim any priority in and to the inventions disclosed therein. Inventors hereby authorize and request the Commissioner of Patents and Trademarks to issue said Letters Patent to said UOP LLC, its successors and assigns. IN WITNESS WHEREOF, the inventors have set their signatures hereunto on the date specified below.

Xin X. Zhu
Xin X. Zhu
10/10/07
Date

State of Illinois; County of Cook
This instrument was acknowledged before me on this 10th
day of October, 2007, by Xin X. Zhu.
Geralyn M. McFadden
Notary Public

(SEAL) "OFFICIAL SEAL"
Geralyn M. McFadden
Notary Public, State of Illinois
My Commission Exp. 11/12/2007

Keith A. Couch
Keith A. Couch
10/15/07
Date

State of Illinois; County of Cook
This instrument was acknowledged before me on this 15th
day of October, 2007, by Keith A. Couch.
Geralyn M. McFadden
Notary Public

(SEAL) "OFFICIAL SEAL"
Geralyn M. McFadden
Notary Public, State of Illinois
My Commission Exp. 11/12/2007

James P. Glavin
James P. Glavin
10/11/07
Date

State of Illinois; County of Cook
This instrument was acknowledged before me on this 11th
day of October, 2007, by James P. Glavin.
Geralyn M. McFadden
Notary Public

(SEAL) "OFFICIAL SEAL"
Geralyn M. McFadden
Notary Public, State of Illinois
My Commission Exp. 11/12/2007

TRADUCCION AL ESPAÑOL del Documento de Cesión a **UOP LLC** firmado por los cedentes y el cesionario.

APOSTILLA

(Convención de La Haya del 5 de Julio de 1961)

1. PAÍS: ESTADOS UNIDOS DE AMÉRICA
ESTE DOCUMENTO PÚBLICO
2. HA SIDO FIRMADO POR ROSE A. NAGEL
3. ACTUANDO EN CAPACIDAD DE NOTARIO PÚBLICO, CONDADO
MCHENRY
4. LLEVA EL SELLO/TIMBRE DEL ESTADO DE ILLINOIS

CERTIFICADO

- | | |
|--|-------------------|
| 5. SPRINGFIELD, ILLINOIS | 6. AGOSTO 8, 2008 |
| 7. POR EL SECRETARIO DE ESTADO, ESTADO DE ILLINOIS | |
| 8. NO. S08KL15064 | |
| 9. SELLO/TIMBRE | 10. FIRMA |

(FIRMA)

JESSE WHITE
SECRETARIO DE ESTADO
ESTADO DE ILLINOIS

Hay un sello que dice:

SELLO DEL ESTADO DE ILLINOIS – AGOSTO 26 DE 1818



UOP LLC
(una compañía de responsabilidad limitada de Delaware)

Certificado del Secretario Asistente

Yo, Frank S. Molinaro, certifico que soy un Secretario Asistente debidamente certificado – Asuntos de Patentes de UOP LLC, una compañía de responsabilidad limitada de Delaware, Estados Unidos de América y que:

- 1) El anexo es una copia verdadera de la cesión plenamente perfeccionada fechada el 10 de octubre de 2007, el 15 de octubre de 2007 y el 11 de octubre de 2007, donde;

Xin X. ZHU
Keith A. COUCH
James P. GLAVIN

Inventores de la invención titulada:

APARATO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC

cedieron su interés mundial en tal invención, así como el presentar solicitudes de patente en Estados Unidos de América para dicha invención, incluyendo los derechos en el extranjero para tal invención, a UOP LLC, una compañía de responsabilidad limitada, organizada bajo las leyes del Estado de Delaware, Estados Unidos de América, y teniendo su oficina principal en Des Plaines, Illinois, Estados Unidos de América;

- 2) que una solicitud para la patente de dicha invención fue presentada en la Oficina de Patentes de los Estados Unidos de América según expediente N° 11/832,143, el 1 de agosto de 2007;
- 3) que la invención así cedida es la misma que la invención respecto de la cual una solicitud para patente en Colombia ha sido titulada:

APARATO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC

COMO TESTIGO, yo he ejecutado este certificado en nombre de UOP LLC, el 28 de julio de 2008.

Firma _____
Frank S. Molinaro
Secretario Asistente – Asuntos de Patentes

RECONOCIMIENTO NOTARIAL

Este instrumento fue reconocido ante mí en el Condado de McHenry, Illinois, EE. UU., el 28 de julio de 2008, por Frank S. Molinaro, Secretario Asistente – Asuntos de Patentes de UOP LLC, una compañía de responsabilidad limitada de Delaware, Estados Unidos de América.

Firma _____
Notario Público

Hay un sello que dice: Sello oficial. Notario Público – Estado de Illinois. Rose A. Nagel. Mi encargo vence: el 26 de noviembre de 2011.

CESIÓN

Asunto legal N° UOP27704-01

CONSIDERANDO QUE, **XIN X. ZHU**, ciudadano del Reino Unido, residente en Long Grove, Illinois; **KEITH A. COUCH**, ciudadano de los Estados Unidos de América, residente en Arlington Heights, Illinois; y **JAMES P GLAVIN**, ciudadano de los Estados Unidos de América, residente en Naperville, Illinois de aquí en adelante considerados como "los inventores", han inventado ciertos mejoramientos útiles y nuevos en **APARATO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC**. CONSIDERANDO QUE los inventores aquí autorizan y requieren que su abogado/agente del expediente el haber insertado en cada página (donde se indica más abajo) la fecha de presentación y el número de la solicitud de dicha presentación cuando se sepa; y CONSIDERANDO QUE UOP LLC, una compañía organizada y existente según las leyes del Estado de Delaware y cuyo principal lugar de negocios es Des Plaines, Illinois, desea adquirir un interés en y para dicha solicitud, donde se divulgaron las invenciones, y las patentes de los Estados Unidos que pueden ser concedidas. AHORA, POR TANTO, por buena y valiosa contraprestación, cuyo recibo aquí se reconoce, dichos inventores efectivamente transfieren y ceden a la mencionada UOP LLC, sus sucesores y asignatarios, el derecho total, el título y el interés en, para y bajo tal solicitud; la invención protegida; cualquiera y todas las patentes resultantes a partir de ahí; cualquier renovación, republicación, extensiones, re-exámenes, sustituciones, continuaciones, o divisiones a partir de ahí y todos los derechos extranjeros derivados, incluyendo todos los derechos a reclamar prioridad en y a las invenciones divulgadas a partir de ahí. Los inventores autorizan y solicitan al Comisionado de Patentes y Marcas a expedir dichas patentes a la mencionada UOP LLC, sus sucesores y asignatarios. COMO TESTIGOS DE LO ANTERIOR, los inventores han puesto sus firmas abajo en la fecha especificada abajo.

<u>Firma</u>	<u>10/10/07</u>
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Estado de Illinois
Condado de Cook

Este instrumento fue reconocido ante mí este 10 de octubre de 2007, por **Xin X. Zhu**.

Firma
Notario Público

(SELLO) Hay un sello que dice:

"SELLO OFICIAL"
Geraldyn M. Mc Fadden
Notario Público, Estado de Illinois
Mi encargo expira el 12/11/2007

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<u>Firma</u>	<u>15/10/07</u>
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Estado de Illinois
Condado de Cook

Este instrumento fue reconocido ante mí este 15 de octubre de 2007, por **Keith A. Couch**.

Firma
Notario Público

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<u>Firma</u>	<u>11/10/07</u>
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Estado de Illinois
Condado de Cook

Este instrumento fue reconocido ante mí este 11 de octubre de 2007, por **James P. Glavin**.

Firma
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Geraldyn M. Mc Fadden
Notario Público, Estado de Illinois
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TO ALL TO WHOM THESE PRESENTS SHALL COME:

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July 28, 2008

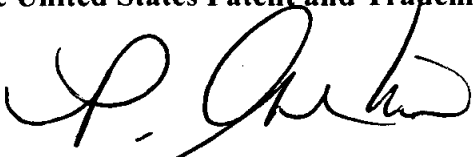
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APPLICATION NUMBER: 11/832,136

FILING DATE: August 01, 2007

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US11/832,136

**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

Electronic Acknowledgement Receipt

EFS ID:	2029136
Application Number:	11832136
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Confirmation Number:	5581
Title of Invention:	Process for Recovering Power from FCC Product
First Named Inventor/Applicant Name:	Xin X Zhu
Customer Number:	23490
Filer:	Maryann Maas./Rose Lubich
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Attorney Docket Number:	uop27704
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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	Application Data Sheet	UOP27704-Application-Data-Sheet.PDF	8507 4eddd0eb224c90e9eb66c8e78fcd8a69f7703661c	no	2
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Drawings	UOP27704-Drawings.PDF	38259 df38bad93c671e947ec2c8e476bbcd4f237a2767	no	2
Warnings:					
Information:					
3		UOP27704-Spec-Claims-Abstract.PDF	98622 dc8ff9420bfc2105bfcd16620012d26c8616ea15	yes	15
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	11	
	Claims		12	14	
	Abstract		15	15	
Warnings:					
Information:					
4	Fee Worksheet (PTO-06)	fee-info.pdf	8359 6944094443445d73a112d52ffa3d8c5064585ec3	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			153747		

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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

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APPLICATION DATA SHEET

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APPLICATION DATA SHEET

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Application Information

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PROCESS FOR RECOVERING POWER FROM FCC PRODUCT

BACKGROUND OF THE INVENTION

[0001] The field of the invention is power recovery from a fluid catalytic cracking (FCC) unit.

5 [0002] FCC technology, now more than 50 years old, has undergone continuous improvement and remains the predominant source of gasoline production in many refineries. This gasoline, as well as lighter products, is formed as the result of cracking heavier (i.e. higher molecular weight), less valuable hydrocarbon feed stocks such as gas oil.

10 [0003] In its most general form, the FCC process comprises a reactor that is closely coupled with a regenerator, followed by downstream hydrocarbon product separation. Hydrocarbon feed contacts catalyst in the reactor to crack the hydrocarbons down to smaller molecular weight products. During this process, the catalyst tends to accumulate coke thereon, which is burned off in the regenerator.

15 [0004] The heat of combustion in the regenerator typically produces flue gas at temperatures of 677° to 788°C (1250° to 1450°F) and at a pressure range of 138 to 276 kPa (20 to 40 psig). Although the pressure is relatively low, the extremely high temperature, high volume of flue gas from the regenerator contains sufficient kinetic energy to warrant economic recovery.

20 [0005] To recover energy from a flue gas stream, flue gas may be fed to a power recovery unit, which for example may include an expander turbine. The kinetic energy of the flue gas is transferred through blades of the expander to a rotor coupled either to a main air blower, to produce combustion air for the FCC regenerator, and/or to a generator to produce electrical power. Because of the pressure drop of 138 to 207 kPa (20 to 30 psi) across the expander turbine, the flue gas typically discharges with a temperature drop of approximately 125° to 25 167°C (225 to 300°F). The flue gas may be run to a steam generator for further energy recovery. A power recovery train may include several devices, such as an expander turbine, a generator, an air blower, a gear reducer, and a let-down steam turbine.

30 [0006] In order to reduce damage to components downstream of the regenerator, it is also known to remove flue gas solids. This is commonly accomplished with first and second stage separators, such as cyclones, located in the regenerator. Some systems also include a third

ge separator (TSS) or even a fourth stage separator (FSS) to remove further fine particles, commonly referred to as "fines".

007] The FCC process produces around 30% of the dry gas produced in a refinery. Dry gas comprises mainly methane, ethane and other light gases. Dry gas is separated from other FCC products at high pressures. FCC dry gas is heavily olefinic and typically used as fuel gas throughout a refinery. Olefinic dry gas, such as dry gas having over 10 wt-% olefins is not suitable for use in gas turbines in which the olefins can cause internal fouling particularly due to the presence of diolefins. In some cases, FCC units produce more dry gas than the refinery consumes. The excess dry gas can be flared which is an environmental concern. To make less dry gas, the riser temperature can be reduced, adversely affecting the product slate, or throughput can be reduced, adversely affecting productivity. Olefinic dry gas can also be obtained from other unit operations such as those that are hydrogen deficient like cokers and steam crackers.

SUMMARY OF THE INVENTION

008] We have discovered a process for improving power recovery from an FCC unit. The process involves combusting product gas with oxygen before being combined with an FCC regenerator flue gas stream to heat the flue gas stream. The combined flue gas is then expanded to recover power or heat exchanged to recover heat. The process may involve expanding the high pressure product gas obtained from an FCC product stream to lower pressure to recover power before combustion. The preferred product gas is dry gas which may be obtained from many hydrocarbon processing reactions which are hydrogen deficient.

009] Advantageously, the process can enable the FCC unit to utilize a low value product stream to produce gasses that are more environmentally friendly.

010] Additional features and advantages of the invention will be apparent from the description of the invention, figures and claims provided herein.

BRIEF DESCRIPTION OF THE DRAWINGS

011] FIG. 1 is a schematic drawing of an FCC unit, a power recovery train and an FCC product recovery system in a refinery.

012] FIG. 2 is a schematic of an alternate embodiment of the invention of FIG. 1.

DETAILED DESCRIPTION

[0013] Now turning to the figures, wherein like numerals designate like components, FIG. 1 illustrates a refinery complex 100 that is equipped for processing streams from an FCC unit for power recovery. The refinery complex 100 generally includes an FCC unit section 10, a power recovery section 60 and a product recovery section 90. The FCC unit section 10 includes a reactor 12 and a catalyst regenerator 14. Process variables typically include a cracking reaction temperature of 400° to 600°C and a catalyst regeneration temperature of 500° to 900°C. Both the cracking and regeneration occur at an absolute pressure below 5 atmospheres. FIG. 1 shows a typical FCC process unit of the prior art, where a heavy hydrocarbon feed or raw oil stream in a line 16 is contacted with a newly regenerated cracking catalyst entering from a regenerated catalyst standpipe 18. This contacting may occur in a narrow riser 20, extending upwardly to the bottom of a reactor vessel 22. The contacting of feed and catalyst is fluidized by gas from a fluidizing line 24. Heat from the catalyst vaporizes the oil, and the oil is thereafter cracked to lighter molecular weight hydrocarbons in the presence of the catalyst as both are transferred up the riser 20 into the reactor vessel 22. The cracked light hydrocarbon products are thereafter separated from the cracking catalyst using cyclonic separators which may include a rough cut separator 26 and one or two stages cyclones 28 in the reactor vessel 22. Product gases exit the reactor vessel 10 through a product outlet 31 to line 32 for transport to a downstream product recovery section 90. Inevitable side reactions occur in the riser 20 leaving coke deposits on the catalyst that lower catalyst activity. The spent or coked catalyst requires regeneration for further use. Coked catalyst, after separation from the gaseous product hydrocarbon, falls into a stripping section 34 where steam is injected through a nozzle to purge any residual hydrocarbon vapor. After the stripping operation, the coked catalyst is fed to the catalyst regenerator 14 through a spent catalyst standpipe 36.

[0014] FIG. 1 depicts a regenerator 14 known as a combustor. However, other types of regenerators are suitable. In the catalyst regenerator 14, a stream of oxygen-containing gas, such as air, is introduced through an air distributor 38 to contact the coked catalyst, burn coke deposited thereon, and provide regenerated catalyst and flue gas. A main air blower 50 is driven by a driver 52 to deliver air or other oxygen containing gas from line 51 into the regenerator 14 through line 30. The driver 52 may be, for example, a motor, a steam turbine driver, or some other device for power input. The catalyst regeneration process adds a

substantial amount of heat to the catalyst, providing energy to offset the endothermic cracking reactions occurring in the reactor conduit 16. Catalyst and air flow upwardly together along a combustor riser 40 located within the catalyst regenerator 14 and, after regeneration, are initially separated by discharge through a disengager 42. Finer separation of the regenerated catalyst and flue gas exiting the disengager 42 is achieved using first and second stage separator cyclones 44, 46, respectively within the catalyst regenerator 14. Catalyst separated from flue gas dispenses through a diplegs from cyclones 44, 46 while flue gas relatively lighter in catalyst sequentially exits cyclones 44, 46 and exits the regenerator vessel 14 through flue gas outlet 47 in line 48. Regenerated catalyst is recycled back to the reactor riser 12 through the regenerated catalyst standpipe 18. As a result of the coke burning, the flue gas vapors exiting at the top of the catalyst regenerator 14 in line 48 contain CO, CO₂ and H₂O, along with smaller amounts of other species.

[0015] Hot flue gas exits the regenerator 14 through the flue gas outlet 47 in a line 48 and enters the power recovery section 60. The power recovery section 60 is in downstream communication with the flue gas outlet 47 via line 48. "Downstream communication" means that at least a portion of the fluid from the upstream component flows into the downstream component. Many types of power recovery configurations are suitable, and the following embodiment is very well suited but not necessary to the present invention. Line 48 directs the flue gas to a heat exchanger 62, which is preferably a high pressure steam generator (e.g., a 4137 kPa (gauge) (600 psig)). Arrows to and from the heat exchanger 62 indicate boiler feed water in and high pressure steam out. The heat exchanger 62 may be a medium pressure steam generator (e.g., a 3102 kPa (gauge) (450 psig)) or a low pressure steam generator (e.g., a 345 kPa (gauge) (50 psig)) in particular situations. As shown in the embodiment of FIG. 1, a boiler feed water (BFW) quench injector 64 may be provided to selectively deliver fluid into conduit 48.

[0016] A supplemental heat exchanger 63 may also be provided downstream of the heat exchanger 62. For example, the supplemental temperature reduction would typically be a low pressure steam generator for which arrows indicate boiler feed water in and low pressure steam out. However, the heat exchanger 63 may be a high or medium pressure steam generator in particular situations. In the embodiment of FIG. 1, conduit 66 provides fluid communication from heat exchanger 62 to the supplemental heat exchanger 63. Flue gas exiting the supplemental heat exchanger 63 is directed by conduit 69 to a waste flue gas line

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67 and ultimately to an outlet stack 68, which is preferably equipped with appropriate environmental equipment, such as an electrostatic precipitator or a wet gas scrubber.

Typically, the flue gas is further cooled in a flue gas cooler 61 to heat exchange with a heat exchange media which is preferably water to generate high pressure steam. Arrows to and from flue gas cooler 61 indicate heat exchange media coming in and heated heat exchange media exiting, which is preferably boiler feed water coming in and steam going out. The illustrated example of FIG. 1 further provides that conduit 69 may be equipped to direct the flue gas through a first multi-hole orifice (MHO) 71, a first flue gas control valve (FGCV) 74, and potentially a second FGCV 75 and second MHO 76 on the path to waste flue gas line 67 all to reduce the pressure of the flue gas in conduit 69 before it reaches the stack 68. FGCV's 74, 75 are typically butterfly valves and may be controlled based on a pressure or temperature reading from the regenerator 14.

[0017] In order to generate electricity, the power recovery section 60 further includes a power recovery expander 70, which is typically a steam turbine, and a power recovery generator ("generator") 78. More specifically, the expander 70 has an output shaft that is typically coupled to an electrical generator 78 by driving a gear reducer 77 that in turn drives the generator 78. The generator 78 provides electrical power that can be used as desired within the plant or externally. Alternatively, the expander 70 may be coupled to the main air blower 50 to serve as its driver, obviating driver 52, but this arrangement is not shown.

[0018] In an embodiment, the power recovery expander 70 is located in downstream communication with the heat exchanger 62. However, a heat exchanger may be upstream or downstream of the expander 70. For example, a conduit 79 feeds flue gas through an isolation valve 81 to a third stage separator (TSS) 80, which removes the majority of remaining solid particles from the flue gas. Clean flue gas exits the TSS 80 in a flue gas line 82 which feeds a flue gas stream to a combine line 54 which drives the expander 70.

[0019] To control flow flue gas between the TSS 80 and the expander 70, an expander inlet control valve 83 and a throttling valve 84 may be provided upstream of the expander 70 to further control the gas flow entering an expander inlet. The order of the valves 83, 84 may be reversed and are preferably butterfly valves. Additionally, a portion of the flue gas stream can be diverted in a bypass line 73 from a location upstream of the expander 70, through a synchronization valve 85, typically a butterfly valve, to join the flue gas in the exhaust line 86. After passing through an isolation valve 87, the clean flue gas in line 86 joins the flowing

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waste gas downstream of the supplemental heat exchanger 63 in waste flue gas line 67 and flows to the outlet stack 68. An optional fourth stage separator 88 can be provided to further remove solids that exit the TSS 80 in an underflow stream in conduit 89. After the underflow stream is further cleaned in the fourth stage separator 88, it can rejoin the flue gas in line 86 after passing through a critical flow nozzle 72 that sets the flow rate therethrough.

[0020] In the product recovery section 90, the gaseous FCC product in line 32 is directed to a lower section of an FCC main fractionation column 92. Several fractions may be separated and taken from the main column including a heavy slurry oil from the bottoms in line 93, a heavy cycle oil stream in line 94, a light cycle oil in line 95 and a heavy naphtha stream in line 96. Any or all of lines 93-96 may be cooled and pumped back to the main column 92 to cool the main column typically at a higher location. Gasoline and gaseous light hydrocarbons are removed in overhead line 97 from the main column 92 and condensed before entering a main column receiver 99. An aqueous stream is removed from a boot in the receiver 99. Moreover, a condensed light naphtha stream is removed in line 101 while a gaseous light hydrocarbon stream is removed in line 102. Both streams in lines 101 and 102 may enter a vapor recovery section 120 of the product recovery section 90.

[0021] The vapor recovery section 120 is shown to be an absorption based system, but any vapor recovery system may be used including a cold box system. To obtain sufficient separation of light gas components the gaseous stream in line 102 is compressed in compressor 104. More than one compressor stage may be used, but typically a dual stage compression is utilized. The compressed light hydrocarbon stream in line 106 is joined by streams in lines 107 and 108, chilled and delivered to a high pressure receiver 110. An aqueous stream from the receiver 110 may be routed to the main column receiver 99. A gaseous hydrocarbon stream in line 112 is routed to a primary absorber 114 in which it is contacted with unstabilized gasoline from the main column receiver 99 in line 101 to effect a separation between C_3^+ and C_2^- . A liquid C_3^+ stream in line 107 is returned to line 106 prior to chilling. An off-gas stream in line 116 from the primary absorber 114 may be used as a selected product stream of the plurality of product streams separated from the FCC product in the present invention or optionally be directed to a secondary absorber 118, where a circulating stream of light cycle oil in line 121 diverted from line 95 absorbs most of the remaining C_5^+ and some C_3 - C_4 material in the off-gas stream. Light cycle oil from the bottom of the secondary absorber in line 119 richer in C_3^+ material is returned to the main

column 92 via the pump-around for line 95. The overhead of the secondary absorber 118 comprising dry gas of predominantly C_2^- hydrocarbons with hydrogen sulfide, amines and hydrogen is removed in line 122 and may be used as a selected product stream of the plurality of product streams separated from the FCC product in the present invention. It is

5 contemplated that another stream may also comprise a selected product stream of the plurality of product streams separated from the FCC product in the present invention

[0022] Liquid from the high pressure receiver 110 in line 124 is sent to a stripper 126.

Most of the C_2^- is removed in the overhead of the stripper 126 and returned to line 106 via overhead line 108. A liquid bottoms stream from the stripper 126 is sent to a debutanizer

10 column 130 via line 128. An overhead stream in line 132 from the debutanizer comprises C_3 - C_4 olefinic product while a bottoms stream in line 134 comprising stabilized gasoline may be further treated and sent to gasoline storage.

[0023] A selected product stream line, preferably line 122 comprising the secondary absorber off-gas containing dry gas may be introduced into an amine absorber unit 140. A

15 lean aqueous amine solution is introduced via line 142 into absorber 140 and is contacted with the flowing dry gas stream to absorb hydrogen sulfide, and a rich aqueous amine absorption solution containing hydrogen sulfide is removed from absorption zone 140 via line

144 and recovered. A selected product stream line preferably comprising a dry gas stream having a reduced concentration of hydrogen sulfide is removed from absorption zone 140 via

20 line 146. Any of lines carrying product from the FCC reactor 12 including lines 114 or 122 and 146 may serve as selected product lines in communication with the downstream power recovery section 60 to transport a selected product stream from the gas recovery section 120 of the product recovery section 90 to the power recovery section 60. Additionally, dry gas may be delivered to the power recovery section 60 from any other source in the refinery 100

25 such as a coker unit or a steam cracker unit.

[0024] The selected FCC product gas from the product recovery section 90 in line 146

can be used in the power recovery section 60 in a continuous process and in the same refinery complex. The power recovery section 60 is in downstream communication with the vapor recovery section of the product recovery section 90 via line 146. As an alternative to sending

30 the selected gas in line 146 to the refinery fuel gas header, the selected product gas may be let down in pressure at a volume increase across an expander 150 to recover pressure energy from the gas. The selected gas is still at the high pressure utilized in the vapor recovery

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section 120 of the product recovery section 90 when delivered to the expander 150 due to operation of the compressor 104. The selected gas exits expander 150 in exhaust line 152. The expander is connected by a shaft 154 to an electrical generator 78 for generating electrical power that can be used in the refinery or exported. Beside connection by shaft 154 to the electrical generator, the expander 150 may alternatively or additionally be connected by a shaft (not shown) to the main air blower 50 for blowing air to the regenerator 14 obviating the need for driver 52. A gear reducer may be provided on the shaft 154 between the expander 150 and the generator 78 in which case the gear reducer (not shown) would connect two shafts of which shaft 154 is one. The expander 150 may be in downstream communication with the selected product line 146 and with vapor recovery section 120 of the product recovery section 90 via line 146.

[0025] It is also contemplated that an additional steam expander (not shown) may be connected by an additional shaft or the same shaft 154 to further turn electrical generator 78 and produce additional electrical power or power the main air blower 50. The additional steam expander would be fed by surplus steam in the refinery. The additional expander could be either an extraction or induction turbine. In the latter case, the additional expander could take the form of an additional chamber in expander 150 or 70 with the surplus steam feeding the additional chamber (not shown). The additional expander may be coupled by a gear reducer (not shown) to the additional shaft or the same shaft 154. It is also contemplated that expanders 70 and 150 could be the same expander with induction feed from line 82, 54 or 146, respectively, introducing a stream to an intermediate chamber of the expander.

[0026] The selected product gas may be used as a flue gas reheating media. Selected product lines 116, 122, 146 and/or 152 communicate the product recovery section 90 with a downstream flue gas heater 156. After, before or instead of power recovery in expander 150 from the selected gas, the selected gas is routed to the flue gas heater 156 in expander exhaust line 152 if the expander 150 is utilized. For example, steam generation in the upstream flue gas power recovery section 60 may have allowed for the majority of the flue gas system to be designed of lower class metallurgy. While this can dramatically reduce the total installed cost of the flue gas power recovery system, it can also reduce the power generation capability across the flue gas expander 70. To regain the electrical power generating capability of the flue gas, selected gas from the product recovery section 90 and suitably from the gas recovery section 120 can be used to re-heat the flue gas on temperature control to a maximum

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permissible inlet temperature of the expander 70. An oxygen-containing gas such as air may be added to the selected product stream in exhaust line 152 from line 158. The oxygen and the selected gas are ignited continuously to combust the selected gas in the flue gas heater 156 and achieve an elevated temperature. The flue gas heater 156 may be in downstream communication with the expander 150.

[0027] In the embodiment of FIG. 1, combust line 160 communicates with and carries hot combusted selected product gas to join line 82 carrying flue gas downstream from the regenerator 14, thus raising the temperature of the flue gas in flue gas line 82 on entering combine line 54. Combust line 160 may deliver hot combusted selected product gas to combine with flue gas stream in flue gas line 82 in downstream communication with the flue gas outlet 47 to line 48 to provide a combined selected product and flue gas stream in combine line 54. Combine line 54 is in downstream communication with the flue gas line 82 and the combust line 160. Combine line 54 communicates lines 82 and 160 with the downstream expander 70. The combine stream of at least a portion of the combusted selected product gas stream with at least a portion of a flue gas stream of elevated temperature are then carried to the expander 70 in line 54 at a higher temperature than in line 82 to produce an even greater quantity of power in the expansion. The expander 70 is in downstream communication with the selected product line 146 and with vapor recovery section 120 of the product recovery section 90 and with line 152. The expander 70 is also in downstream communication with the flue gas heater 156 via lines 160 and 54.

[0028] This arrangement is economically attractive as it may maximize utilization of existing assets, but it also allows for the burning of olefin rich dry gas from the FCC reactor 12 or other reactor in which hydrogen is deficient, which is not viable for use in gas turbines in which the olefins can cause internal fouling. The reheated flue gas is processed through the expander 70 for maximum power generation. The outlet line 86 from the expander 70 communicates with a downstream heat exchanger 61 which may be a steam generator via line flue gas lines 69 and 67. The heat exchanger 61 is in downstream communication with the expander 70. The heat exchanger 61 is also in downstream communication with the flue gas heater 156 via lines 160, 54, 86, 69 and 67. The residual heat energy may be recovered by directing the combined selected product and flue gas stream in line 86 to the downstream flue gas cooler 61 via lines 66 and 67. In the flue gas cooler 61, heat exchange media is heat exchanged with the combine stream preferably for steam generation. The power generation

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capacity of the flue gas in expander 70 may increase by a factor of 1.8 to 2.2 by combining combusted selected product gas from combust line 160 with the flue gas stream in line 82.

The selected product gas may be used to reheat the flue gas whether or not it is routed through expander 150, but prior recovery of the pressure energy may be preferable.

5 [0029] FIG. 2 shows an alternative embodiment in which most elements are the same as in FIG. 1 indicated by like reference numerals but with differences in configuration indicated by designating the reference numeral with a prime symbol ("'). The combust line 160' from the flue gas heater communicates with a downstream heat exchanger 61, preferably a steam generator, via a combine line 56. Line 160' feeds combusted selected product gas to join
10 waste flue gas line 67 carrying flue gas downstream of the flue gas outlet 47 of the regenerator 14 to provide a combined combusted selected product and flue gas stream in combine line 56. Line 67 is in downstream communication with the turbine exhaust line 86. Combine line 56 carries the combined selected product and flue gas stream at a higher temperature than the flue gas in waste flue gas line 67 to the flue gas cooler heat exchanger
15 61 to obtain an even greater heat exchange or recovery of high quality steam. Combine line 56 is in downstream communication with combust line 160' and flue gas line 67. The heat exchanger 61 is in downstream communication with the flue gas heater 156 and lines 160' and 56. It is also contemplated that exhaust line 160' feed lines 48 or 66 to immediately improve steam generation in downstream steam generators 62 or 63, respectively. Therefore,
20 if a refiner has a greater demand for steam than for power, the embodiment of FIG. 2 may be more advantageous than that of FIG. 1.

EXAMPLE

[0030] For example, per the following data inputs and calculated output, the dry gas production from an FCC unit would be used to generate a rather substantial 2.05 MW through
5 an expander.

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Dry Gas Stream Property		
Mass flow rate	69380 kg/hr	152,636 lb/hr
Pressure to expander inlet	13.2 kg/cm ² g	202.4 psia
Pressure from expander outlet	2.5 kg/cm ² g	50.26 psia
Temperature at expander inlet	38°C	100°F
Molecular weight	21.7	
UOP K value	1.22	
Critical temperature	427°C	801°F
Critical Pressure	687 kg/cm ² g	9771 psia

[0031] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. It should be understood that the illustrated embodiments are exemplary only, and should not be taken as limiting the scope of the invention.

CLAIMS:

1. A process for processing streams from a fluid catalytic cracking unit comprising:
contacting cracking catalyst with a hydrocarbon feed stream to crack the
hydrocarbons to gaseous product hydrocarbons having lower molecular weight
and deposit coke on the catalyst to provide coked catalyst;
separating said coked catalyst from said gaseous product hydrocarbons;
adding oxygen to said coked catalyst;
combusting coke on said coked catalyst with oxygen to regenerate said catalyst and
provide flue gas;
separating said catalyst from said flue gas to provide a flue gas stream;
separating said gaseous product hydrocarbons to obtain a plurality of product streams
including a selected product stream; and
combining at least a portion of said selected product stream with at least a portion of
said flue gas stream to provide a combined stream.
2. The process of claim 1 further including:
adding oxygen to said selected product stream;
combusting said selected product stream with oxygen; and
combining said combusted selected product stream with said flue gas stream to
provide said combined stream.
3. The process of claim 2 further including:
delivering said combined stream to an expander;
expanding the volume of said combined stream in said expander; and
recovering power from said combined stream in said expander.
4. The process of claim 3 wherein said power is recovered in an expander coupled to
an air blower to the regenerator.
5. The process of claim 3 wherein said power is recovered in an expander coupled to
an electrical generator.
6. The process of claim 3 further including indirectly exchanging heat from said
combined stream with a heat exchange media.
7. The process of claim 6 further including indirectly exchanging heat from said
combined stream with water to generate steam.
8. The process of claim 1 further including:

delivering said selected product stream to an expander;
expanding the volume of said selected product stream in said expander; and
recovering power from said selected product stream in said expander.

9. The process of claim 8 further including:

delivering said combined stream to a second expander; and
recovering power from said combined stream in said second expander.

10. The process of claim 8 further including indirectly exchanging heat from said combined stream with water to generate steam.

11. The process of claim 1 wherein said selected product stream is taken from a vapor recovery section.

12. A process for upgrading the heat content of a flue gas stream from a fluid catalytic cracking unit comprising:

contacting cracking catalyst with a hydrocarbon feed stream to crack the
hydrocarbons to gaseous product hydrocarbons having lower molecular weight
and deposit coke on the catalyst to provide coked catalyst;

separating said coked catalyst from said gaseous product hydrocarbons;

adding oxygen to said coked catalyst;

combusting coke on said coked catalyst with oxygen to regenerate said catalyst and
provide flue gas;

separating said catalyst from said flue gas to provide a flue gas stream;

obtaining a dry gas stream;

adding oxygen to said dry gas stream;

combusting said dry gas stream with oxygen to provide a combusted dry gas stream;
and

combining at least a portion of said combusted dry gas stream with at least a portion
of said flue gas to provide a combined dry gas and flue gas stream.

13. The process of claim 12 further including expanding said combined stream to a lower pressure to recover power.

14. The process of claim 13 wherein said power is recovered in an expander coupled to an air blower to the regenerator.

15. The process of claim 13 wherein said power is recovered in an expander coupled to an electrical generator.

16. The process of claim 12 further including heat exchanging said combined stream with a heat exchange media.

17. The process of claim 16 further including heat exchanging said combined stream with water to generate steam.

5 18. A process for recovering power from a fluid catalytic cracking effluent comprising:

contacting cracking catalyst with a hydrocarbon feed stream to crack the hydrocarbons to gaseous product hydrocarbons with lower molecular weight and deposit coke on the catalyst to provide coked catalyst;

10 separating said coked catalyst from said gaseous product hydrocarbons;

adding oxygen to said coked catalyst;

combusting coke on said coked catalyst with oxygen to regenerate said catalyst and provide flue gas;

separating said catalyst from said flue gas;

15 fractionating said gaseous product hydrocarbons to obtain a plurality of product streams;

obtaining a dry gas stream from said plurality of product streams;

adding oxygen to said dry gas stream;

combusting said dry gas stream with oxygen to provide a combusted dry gas stream;

20 and

combining said combusted dry gas stream with said flue gas to provide a combined stream.

19. The process of claim 18 further including:

delivering said combined stream to an expander; and

25 recovering power from said combined dry gas stream and flue gas in said expander.

20. The process of claim 18 further including indirectly exchanging heat from said combined stream with water to generate steam.

40

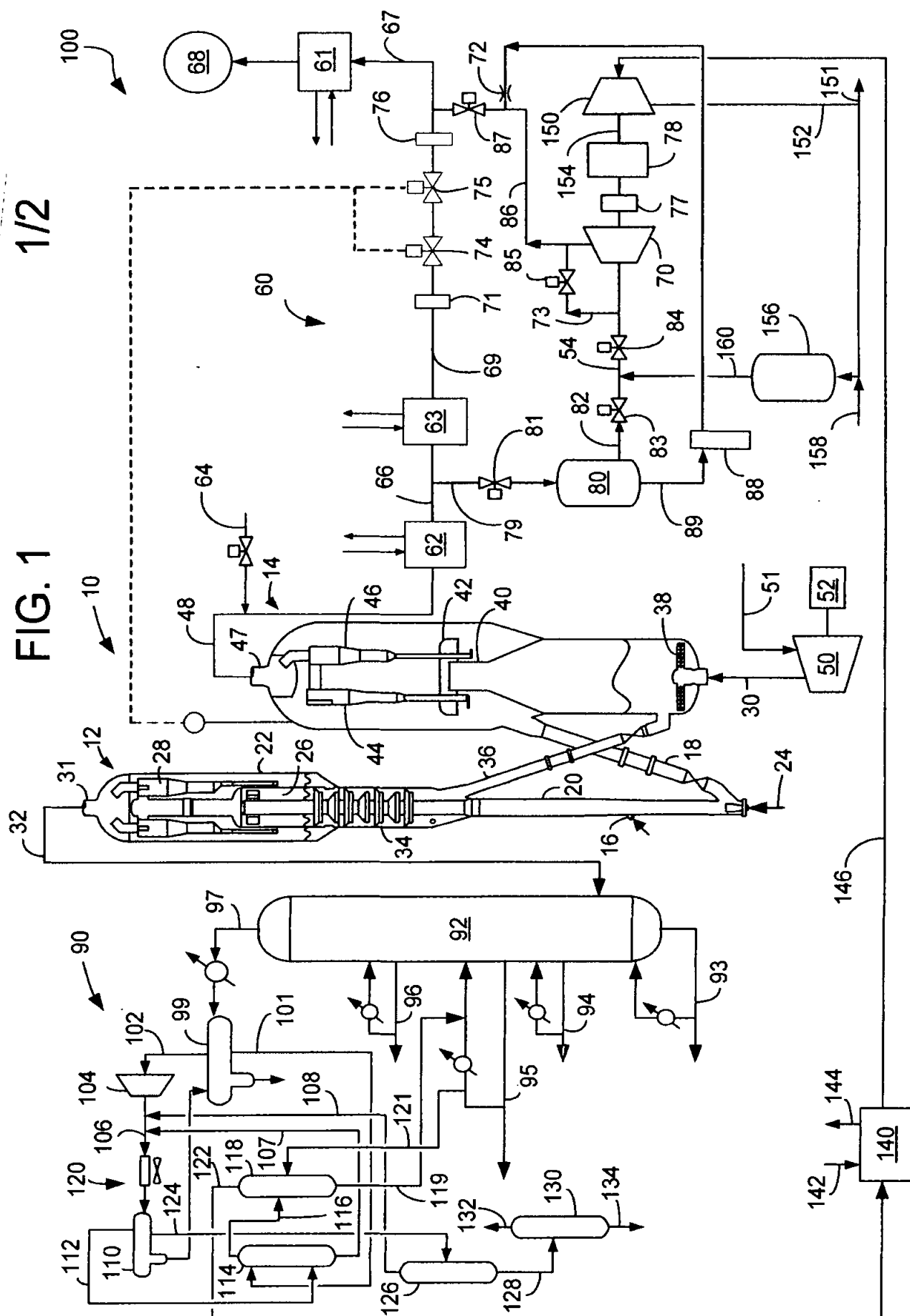
ABSTRACT

Disclosed is a process for recovering power from an FCC product. The dry gas is combusted and combined with FCC regenerator flue gas to raise the power recovery capability of the flue gas. The flue gas can be used to generate electrical power or steam.

- 5 Alternatively or additionally, dry gas from an FCC product stream is separated and delivered to an expander to recover power before combustion.

FIG. 1

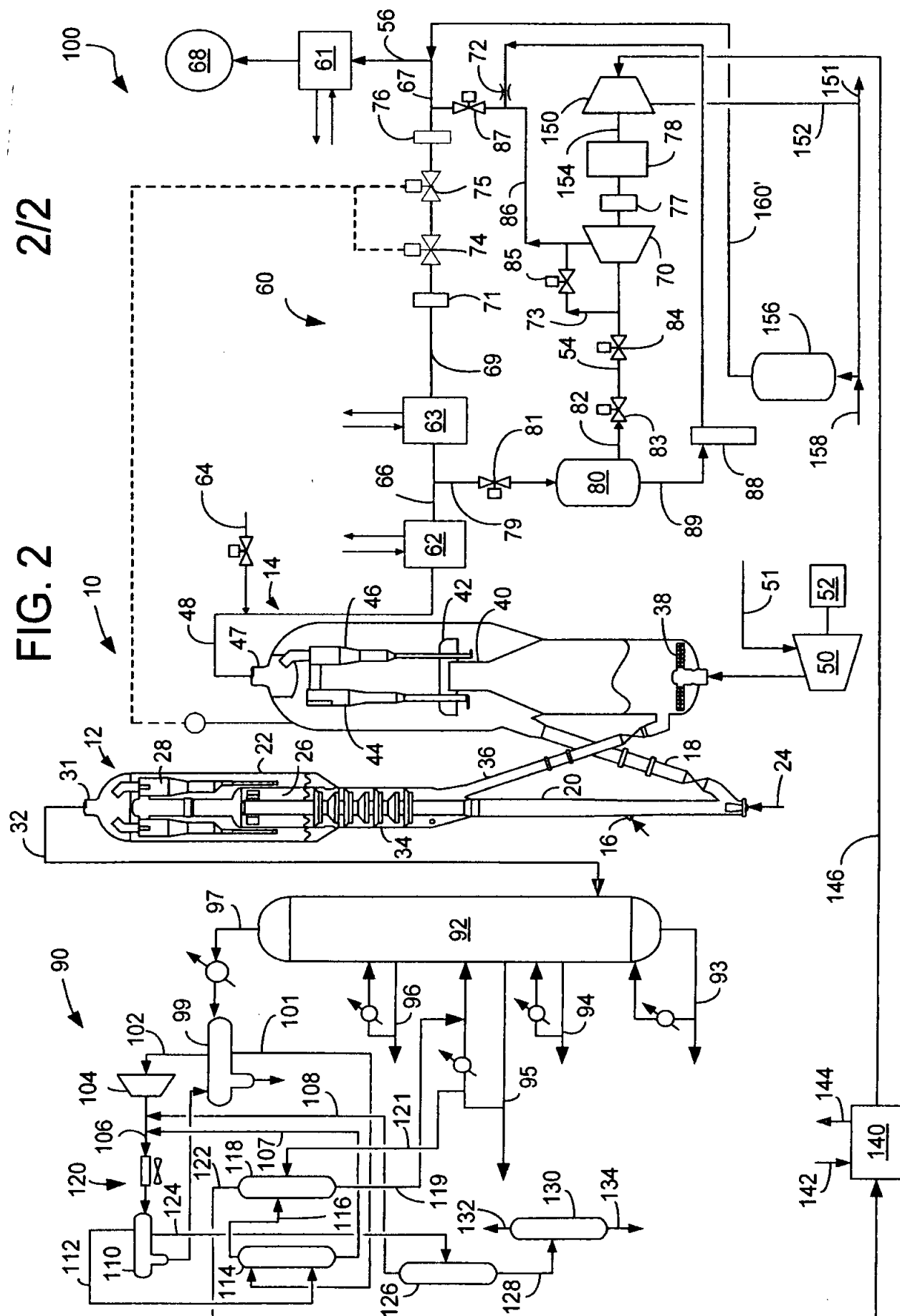
1/2



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FIG. 2
2/2

2/2



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TRADUCCIÓN DEL INGLÉS AL ESPAÑOL del documento de prioridad
relacionado con la Solicitud de Patente de los Estados Unidos de América No.
11/832,136 titulada: \

PROCESO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC

ANEXOS. La solicitud de Patente de los Estados Unidos No. 11/832,136 arriba
mencionada y Certificación del Comisionado de Patentes y Marcas de los Estados
Unidos.

LOS ESTADOS UNIDOS DE AMÉRICA
A TODO AQUEL QUE PUEDA LLEGARLE LA PRESENTE:

DEPARTAMENTO DE COMERCIO DE ESTADOS UNIDOS
Oficina de Marcas y Patentes de Estados Unidos

Julio 28, 2008

ESTE ES PARA CERTIFICAR QUE EL ANEXO ES UNA COPIA VERDADERA DE
LOS ARCHIVOS DE LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS
UNIDOS DE TALES DOCUMENTOS DE LA SOLICITUD PARA PATENTE
IDENTIFICADA ABAJO LA CUAL CUMPLIÓ CON LOS REQUERIMIENTOS
PARA OTORGARSELE UNA FECHA DE PRESENTACION BAJO 35 USC 111

NUMERO DE SOLICITUD: 11/832,136

FECHA DE PRESENTACIÓN: Agosto 1, 2007

EL CODIGO DE PAIS Y NUMERO DE PRIORIDAD DE LA SOLICITUD PARA
SER UTILIZADOS EN LA PRESENTACIÓN EN EL EXTERIOR BAJO LA
CONVENCION DE PARIS ES US11/832,136

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

Hay un sello que dice:

Oficina de Marcas y
Patentes de Estados Unidos
Departamento de Comercio

(firma)
P. SWAIN
Funcionario que Certifica

REIVINDICACIONES:

1. Un proceso para procesar corrientes provenientes de una unidad de craqueo catalítico tipo fluido, el cual comprende:
contactar el catalizador de craqueo con una corriente de carga de hidrocarburos para craquear los hidrocarburos en productos hidrocarburos gaseosos con un peso molecular menor y depositar coque en el catalizador para proporcionar catalizador coquizado;
separar el citado catalizador coquizado de los citados productos hidrocarburos gaseosos;
agregar oxígeno al citado catalizador coquizado;
quemar coque en el citado catalizador coquizado con oxígeno para regenerar el citado catalizador y proporcionar gas de chimenea;
separar el citado catalizador del citado gas de chimenea para proporcionar una corriente de gas de chimenea;
separar los citados productos hidrocarburos gaseosos para obtener una pluralidad de corrientes de producto, incluida una corriente de producto seleccionado; y
combinar por lo menos una porción de la citada corriente de producto seleccionado con por lo menos una porción de la citada corriente de gas de regeneración para proporcionar una corriente combinada.
2. El proceso de la reivindicación 1 que incluye además:
agregar oxígeno a la citada corriente de producto seleccionado;
quemar la citada corriente de producto seleccionado con oxígeno; y
combinar la citada corriente de producto seleccionado quemado con la citada corriente de gas de chimenea para proporcionar la citada corriente combinada.
3. El proceso de la reivindicación 2 que incluye además:
entregar la citada corriente combinada a un expansor;
expandir el volumen de la citada corriente combinada en el citado expansor; y
recuperar energía de la citada corriente combinada en el citado expansor.
4. El proceso de la reivindicación 3 que incluye además intercambiar calor indirectamente de la citada corriente combinada con un medio intercambiador de calor.

5. El proceso de la reivindicación 3 en donde el mencionado poder es recuperado en un extensor acoplado a un generador eléctrico.
6. El proceso de la reivindicación 3 además incluyendo indirectamente el intercambio de calor del mencionado flujo combinado con un medio de intercambio de calor.
7. El proceso de la reivindicación 6 además incluyendo indirectamente el intercambio de calor del mencionado flujo combinado con agua para generar vapor.
8. el proceso de la reivindicación 1 además incluyendo:
 - entrega del mencionado flujo de producto seleccionado a un extensor;
 - expansión del volumen del mencionado flujo de producto seleccionado en un extensor; y
 - recuperación de poder del mencionado flujo de producto seleccionado en el mencionado extensor.
9. El proceso de la reivindicación 8 además de incluir:
 - entrega del mencionado flujo combinado a un segundo extensor; y
 - recuperación de poder del mencionado flujo combinado en el mencionado segundo extensor.
10. El proceso de la reivindicación 8 además incluyendo indirecto intercambio de calor del mencionado flujo con agua para generar vapor.
11. El proceso de la reivindicación 1 en donde el mencionado flujo de producto seleccionado es tomado de una sección de recuperación de vapor.
12. Un proceso para mejorar el contenido de calor de un flujo de gas de combustión desde una unidad de craqueo de fluido catalítico que comprende:
 - Contacto de catalizador de craqueo con un flujo alimentador de hidrocarburo a los hidrocarburos de producto gaseoso que tengan más bajo peso molecular y deposito de coque en el catalizador para proveer coque catalizador;
 - Separación de dicho catalizador coqueado de los mencionados hidrocarburos de producto gaseoso;
 - Adición de oxígeno al mencionado catalizador coqueado;
 - Combustión de coque en el mencionado catalizador coqueado con oxígeno para regenerar el mencionado catalizador y proveer gas de combustión;

4X

Separación del mencionado catalizador del mencionado gas de combustión para proveer un flujo de gas de combustión;

Obtención de un flujo de gas seco;

Adición de oxígeno al mencionado flujo de gas seco;

Combustión del mencionado flujo de gas seco con oxígeno para proveer un flujo de gas seco quemado;

Y

Combinación de al menos una porción del mencionado flujo de gas seco quemado con al menos una porción del mencionado gas de combustión para proveer un combinado de flujo de gas seco y gas de combustión.

13. El proceso de la reivindicación 12 además incluyendo la expansión del mencionado flujo combinado a una presión más baja para recuperar poder.
14. El proceso de la reivindicación 13 en donde el mencionado poder es recuperado en un extensor acoplado a una salida de aire al regenerador.
15. El proceso de la reivindicación 13 en donde el mencionado poder es recuperado en un extensor acoplado a un generador eléctrico.
16. El proceso de la reivindicación 12 además incluyendo intercambio de calor del mencionado flujo combinado con un medio de intercambio de calor.
17. El proceso de la reivindicación 16 además incluyendo intercambio de calor del mencionado flujo combinado con agua para generar vapor.
18. Un proceso para la recuperación de poder de efluente de craqueo catalítico fluido que comprende:

Contacto del catalizador de craqueo con un flujo alimentador de hidrocarburo para craquear los hidrocarburos a hidrocarburos de producto gaseosos con un bajo peso molecular y depósito de coque en el catalizador para proveer catalizador coqueado;

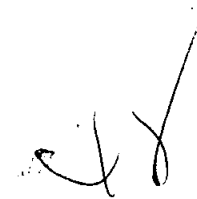
Separación del mencionado catalizador coqueado de mencionados hidrocarburos de producto gaseosos;

Adición de oxígeno al mencionado catalizador coqueado;

Combustión de coque en el mencionado catalizador coqueado con oxígeno para regenerar el mencionado catalizador y proveer gas de combustión;

Separación del mencionado catalizador del mencionado gas de combustión;

Fraccionamiento de los mencionados hidrocarburos de producto gaseosos para obtener una pluralidad de flujos de producto;



Obtención de un flujo de gas seco con oxígeno para proveer un flujo de gas seco quemado

Y

Combinación del mencionado flujo de gas seco quemado con el mencionado gas de combustión para proveer un flujo combinado.

19. El proceso de la reivindicación 18 además incluyendo:

Entrega de mencionado flujo combinado a un extensor; y

Recuperación de poder del mencionado flujo de gas seco combinado y gas de combustión en el mencionado extensor.

20. el proceso de la reivindicación 18 además incluyendo indirectamente el intercambio de calor del mencionado flujo combinado con agua para generar vapor.

PA 1711709

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 28, 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: 11/832,143

FILING DATE: August 01, 2007

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY
APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS
CONVENTION, IS US11/832,143

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

*L. Edelen*

L. EDELEN
Certifying Officer

Electronic Acknowledgement Receipt

EFS ID:	2030041
Application Number:	11832143
International Application Number:	
Confirmation Number:	5592
Title of Invention:	Apparatus for Recovering Power from FCC Product
First Named Inventor/Applicant Name:	Xin X Zhu
Customer Number:	23490
Filer:	Maryann Maas./Rose Lubich
Filer Authorized By:	Maryann Maas.
Attorney Docket Number:	uop27704-01
Receipt Date:	01-AUG-2007
Filing Date:	
Time Stamp:	14:24:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	\$ 1000
RAM confirmation Number	8602
Deposit Account	011125
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	Application Data Sheet	UOP27704-01-Application-Data-Sheet.PDF	8090 907879f31e80c5da5347a67da656833d bc9039cd	no	2
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Drawings	UOP27704-01-Drawings.PDF	39286 561e21457990b371baa0eeceb5e500b 5b0a4d734	no	2
Warnings:					
Information:					
3		UOP27704-01-Spec-Claims-Abstract.PDF	100840 0d54d4a7b48071f333928aaec7e772e9 a886c725	yes	15
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	11	
	Claims		12	14	
	Abstract		15	15	
Warnings:					
Information:					
4	Fee Worksheet (PTO-06)	fee-info.pdf	8351 6ed377b4f94a32870aa1dc7403276c5b de9703e2	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			156567		

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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.

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APPLICATION DATA SHEET

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APPLICATION DATA SHEET

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Application Information

Title Line One:: Apparatus for Recovering Power from FCC
Title Line Two:: Product
Total Drawing Sheets:: 2
Formal Drawings?: Yes
Application Type:: Utility
Docket Number:: UOP27704-01

Representative Information

Representative Customer Number:: 23490

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APPARATUS FOR RECOVERING POWER FROM FCC PRODUCT

BACKGROUND OF THE INVENTION

[0001] The field of the invention is power recovery from a fluid catalytic cracking (FCC) unit.

5 [0002] FCC technology, now more than 50 years old, has undergone continuous improvement and remains the predominant source of gasoline production in many refineries. This gasoline, as well as lighter products, is formed as the result of cracking heavier (i.e. higher molecular weight), less valuable hydrocarbon feed stocks such as gas oil.

10 [0003] In its most general form, the FCC process comprises a reactor that is closely coupled with a regenerator, followed by downstream hydrocarbon product separation. Hydrocarbon feed contacts catalyst in the reactor to crack the hydrocarbons down to smaller molecular weight products. During this process, the catalyst tends to accumulate coke thereon, which is burned off in the regenerator.

15 [0004] The heat of combustion in the regenerator typically produces flue gas at temperatures of 677° to 788°C (1250° to 1450°F) and at a pressure range of 138 to 276 kPa (20 to 40 psig). Although the pressure is relatively low, the extremely high temperature, high volume of flue gas from the regenerator contains sufficient kinetic energy to warrant economic recovery.

20 [0005] To recover energy from a flue gas stream, flue gas may be fed to a power recovery unit, which for example may include an expander turbine. The kinetic energy of the flue gas is transferred through blades of the expander to a rotor coupled either to a main air blower, to produce combustion air for the FCC regenerator, and/or to a generator to produce electrical power. Because of the pressure drop of 138 to 207 kPa (20 to 30 psi) across the expander turbine, the flue gas typically discharges with a temperature drop of approximately 125° to

25 167°C (225 to 300°F). The flue gas may be run to a steam generator for further energy recovery. A power recovery train may include several devices, such as an expander turbine, a generator, an air blower, a gear reducer, and a let-down steam turbine.

30 [0006] In order to reduce damage to components downstream of the regenerator, it is also known to remove flue gas solids. This is commonly accomplished with first and second stage separators, such as cyclones, located in the regenerator. Some systems also include a third

stage separator (TSS) or even a fourth stage separator (FSS) to remove further fine particles, commonly referred to as "fines".

[0007] The FCC process produces around 30% of the dry gas produced in a refinery. Dry gas comprises mainly methane, ethane and other light gases. Dry gas is separated from other FCC products at high pressures. FCC dry gas is heavily olefinic and typically used as fuel gas throughout a refinery. Olefinic dry gas, such as dry gas having over 10 wt-% olefins is not viable for use in gas turbines in which the olefins can cause internal fouling particularly due to the presence of diolefins. In some cases, FCC units produce more dry gas than the refinery consumes. The excess dry gas can be flared which is an environmental concern. To make less dry gas, the riser temperature can be reduced, adversely affecting the product slate, or throughput can be reduced, adversely affecting productivity. Olefinic dry gas can also be obtained from other unit operations such as those that are hydrogen deficient like cokers and steam crackers.

SUMMARY OF THE INVENTION

[0008] We have discovered an apparatus for improving power recovery from an FCC unit. The apparatus involves combusting product gas with oxygen before being combined with an FCC regenerator flue gas stream to heat the flue gas stream. The combined flue gas is then expanded to recover power or heat exchanged to recover heat. The apparatus may involve expanding the high pressure product gas obtained from an FCC product stream to lower pressure to recover power before combustion. The preferred product gas is dry gas which may be obtained from many hydrocarbon processing reactions which are hydrogen deficient.

[0009] Advantageously, the apparatus can enable the FCC unit to utilize a low value product stream to produce gasses that are more environmentally friendly.

[0010] Additional features and advantages of the invention will be apparent from the description of the invention, figures and claims provided herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a schematic drawing of an FCC unit, a power recovery train and an FCC product recovery system in a refinery.

[0012] FIG. 2 is a schematic of an alternate embodiment of the invention of FIG. 1.

DETAILED DESCRIPTION

[0013] Now turning to the figures, wherein like numerals designate like components, FIG. 1 illustrates a refinery complex 100 that is equipped for processing streams from an FCC unit for power recovery. The refinery complex 100 generally includes an FCC unit section 10, a power recovery section 60 and a product recovery section 90. The FCC unit section 10 includes a reactor 12 and a catalyst regenerator 14. Process variables typically include a cracking reaction temperature of 400° to 600°C and a catalyst regeneration temperature of 500° to 900°C. Both the cracking and regeneration occur at an absolute pressure below 5 atmospheres. FIG. 1 shows a typical FCC process unit of the prior art, where a heavy hydrocarbon feed or raw oil stream in a line 16 is contacted with a newly regenerated cracking catalyst entering from a regenerated catalyst standpipe 18. This contacting may occur in a narrow riser 20, extending upwardly to the bottom of a reactor vessel 22. The contacting of feed and catalyst is fluidized by gas from a fluidizing line 24. Heat from the catalyst vaporizes the oil, and the oil is thereafter cracked to lighter molecular weight hydrocarbons in the presence of the catalyst as both are transferred up the riser 20 into the reactor vessel 22. The cracked light hydrocarbon products are thereafter separated from the cracking catalyst using cyclonic separators which may include a rough cut separator 26 and one or two stages cyclones 28 in the reactor vessel 22. Product gases exit the reactor vessel 10 through a product outlet 31 to line 32 for transport to a downstream product recovery section 90. Inevitable side reactions occur in the riser 20 leaving coke deposits on the catalyst that lower catalyst activity. The spent or coked catalyst requires regeneration for further use. Coked catalyst, after separation from the gaseous product hydrocarbon, falls into a stripping section 34 where steam is injected through a nozzle to purge any residual hydrocarbon vapor. After the stripping operation, the coked catalyst is fed to the catalyst regenerator 14 through a spent catalyst standpipe 36.

[0014] FIG. 1 depicts a regenerator 14 known as a combustor. However, other types of regenerators are suitable. In the catalyst regenerator 14, a stream of oxygen-containing gas, such as air, is introduced through an air distributor 38 to contact the coked catalyst, burn coke deposited thereon, and provide regenerated catalyst and flue gas. A main air blower 50 is driven by a driver 52 to deliver air or other oxygen containing gas from line 51 into the regenerator 14 through line 30. The driver 52 may be, for example, a motor, a steam turbine driver, or some other device for power input. The catalyst regeneration process adds a

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substantial amount of heat to the catalyst, providing energy to offset the endothermic cracking reactions occurring in the reactor conduit 16. Catalyst and air flow upwardly together along a combustor riser 40 located within the catalyst regenerator 14 and, after regeneration, are initially separated by discharge through a disengager 42. Finer separation of the regenerated catalyst and flue gas exiting the disengager 42 is achieved using first and second stage separator cyclones 44, 46, respectively within the catalyst regenerator 14. Catalyst separated from flue gas dispenses through a diplegs from cyclones 44, 46 while flue gas relatively lighter in catalyst sequentially exits cyclones 44, 46 and exits the regenerator vessel 14 through flue gas outlet 47 in line 48. Regenerated catalyst is recycled back to the reactor riser 12 through the regenerated catalyst standpipe 18. As a result of the coke burning, the flue gas vapors exiting at the top of the catalyst regenerator 14 in line 48 contain CO, CO₂ and H₂O, along with smaller amounts of other species.

[0015] Hot flue gas exits the regenerator 14 through the flue gas outlet 47 in a line 48 and enters the power recovery section 60. The power recovery section 60 is in downstream communication with the flue gas outlet 47 via line 48. "Downstream communication" means that at least a portion of the fluid from the upstream component flows into the downstream component. Many types of power recovery configurations are suitable, and the following embodiment is very well suited but not necessary to the present invention. Line 48 directs the flue gas to a heat exchanger 62, which is preferably a high pressure steam generator (e.g., a 4137 kPa (gauge) (600 psig)). Arrows to and from the heat exchanger 62 indicate boiler feed water in and high pressure steam out. The heat exchanger 62 may be a medium pressure steam generator (e.g., a 3102 kPa (gauge) (450 psig)) or a low pressure steam generator (e.g., a 345 kPa (gauge) (50 psig)) in particular situations. As shown in the embodiment of FIG. 1, a boiler feed water (BFW) quench injector 64 may be provided to selectively deliver fluid into conduit 48.

[0016] A supplemental heat exchanger 63 may also be provided downstream of the heat exchanger 62. For example, the supplemental temperature reduction would typically be a low pressure steam generator for which arrows indicate boiler feed water in and low pressure steam out. However, the heat exchanger 63 may be a high or medium pressure steam generator in particular situations. In the embodiment of FIG. 1, conduit 66 provides fluid communication from heat exchanger 62 to the supplemental heat exchanger 63. Flue gas exiting the supplemental heat exchanger 63 is directed by conduit 69 to a waste flue gas line

67 and ultimately to an outlet stack 68, which is preferably equipped with appropriate environmental equipment, such as an electrostatic precipitator or a wet gas scrubber.

Typically, the flue gas is further cooled in a flue gas cooler 61 to heat exchange with a heat exchange media which is preferably water to generate high pressure steam. Arrows to and from flue gas cooler 61 indicate heat exchange media coming in and heated heat exchange media exiting, which is preferably boiler feed water coming in and steam going out. The illustrated example of FIG. 1 further provides that conduit 69 may be equipped to direct the flue gas through a first multi-hole orifice (MHO) 71, a first flue gas control valve (FGCV) 74, and potentially a second FGCV 75 and second MHO 76 on the path to waste flue gas line 67 all to reduce the pressure of the flue gas in conduit 69 before it reaches the stack 68. FGCV's 74, 75 are typically butterfly valves and may be controlled based on a pressure or temperature reading from the regenerator 14.

[0017] In order to generate electricity, the power recovery section 60 further includes a power recovery expander 70, which is typically a steam turbine, and a power recovery generator ("generator") 78. More specifically, the expander 70 has an output shaft that is typically coupled to an electrical generator 78 by driving a gear reducer 77 that in turn drives the generator 78. The generator 78 provides electrical power that can be used as desired within the plant or externally. Alternatively, the expander 70 may be coupled to the main air blower 50 to serve as its driver, obviating driver 52, but this arrangement is not shown.

[0018] In an embodiment, the power recovery expander 70 is located in downstream communication with the heat exchanger 62. However, a heat exchanger may be upstream or downstream of the expander 70. For example, a conduit 79 feeds flue gas through an isolation valve 81 to a third stage separator (TSS) 80, which removes the majority of remaining solid particles from the flue gas. Clean flue gas exits the TSS 80 in a flue gas line 82 which feeds a flue gas stream to a combine line 54 which drives the expander 70.

[0019] To control flow flue gas between the TSS 80 and the expander 70, an expander inlet control valve 83 and a throttling valve 84 may be provided upstream of the expander 70 to further control the gas flow entering an expander inlet. The order of the valves 83, 84 may be reversed and are preferably butterfly valves. Additionally, a portion of the flue gas stream can be diverted in a bypass line 73 from a location upstream of the expander 70, through a synchronization valve 85, typically a butterfly valve, to join the flue gas in the exhaust line 86. After passing through an isolation valve 87, the clean flue gas in line 86 joins the flowing

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waste gas downstream of the supplemental heat exchanger 63 in waste flue gas line 67 and flows to the outlet stack 68. An optional fourth stage separator 88 can be provided to further remove solids that exit the TSS 80 in an underflow stream in conduit 89. After the underflow stream is further cleaned in the fourth stage separator 88, it can rejoin the flue gas in line 86 after passing through a critical flow nozzle 72 that sets the flow rate therethrough.

[0020] In the product recovery section 90, the gaseous FCC product in line 32 is directed to a lower section of an FCC main fractionation column 92. Several fractions may be separated and taken from the main column including a heavy slurry oil from the bottoms in line 93, a heavy cycle oil stream in line 94, a light cycle oil in line 95 and a heavy naphtha stream in line 96. Any or all of lines 93-96 may be cooled and pumped back to the main column 92 to cool the main column typically at a higher location. Gasoline and gaseous light hydrocarbons are removed in overhead line 97 from the main column 92 and condensed before entering a main column receiver 99. An aqueous stream is removed from a boot in the receiver 99. Moreover, a condensed light naphtha stream is removed in line 101 while a gaseous light hydrocarbon stream is removed in line 102. Both streams in lines 101 and 102 may enter a vapor recovery section 120 of the product recovery section 90.

[0021] The vapor recovery section 120 is shown to be an absorption based system, but any vapor recovery system may be used including a cold box system. To obtain sufficient separation of light gas components the gaseous stream in line 102 is compressed in compressor 104. More than one compressor stage may be used, but typically a dual stage compression is utilized. The compressed light hydrocarbon stream in line 106 is joined by streams in lines 107 and 108, chilled and delivered to a high pressure receiver 110. An aqueous stream from the receiver 110 may be routed to the main column receiver 99. A gaseous hydrocarbon stream in line 112 is routed to a primary absorber 114 in which it is contacted with unstabilized gasoline from the main column receiver 99 in line 101 to effect a separation between C_3^+ and C_2^- . A liquid C_3^+ stream in line 107 is returned to line 106 prior to chilling. An off-gas stream in line 116 from the primary absorber 114 may be used as a selected product stream of the plurality of product streams separated from the FCC product in the present invention or optionally be directed to a secondary absorber 118, where a circulating stream of light cycle oil in line 121 diverted from line 95 absorbs most of the remaining C_5^+ and some C_3 - C_4 material in the off-gas stream. Light cycle oil from the bottom of the secondary absorber in line 119 richer in C_3^+ material is returned to the main

column 92 via the pump-around for line 95. The overhead of the secondary absorber 118 comprising dry gas of predominantly C_2^- hydrocarbons with hydrogen sulfide, amines and hydrogen is removed in line 122 and may be used as a selected product stream of the plurality of product streams separated from the FCC product in the present invention. It is

5 contemplated that another stream may also comprise a selected product stream of the plurality of product streams separated from the FCC product in the present invention

[0022] Liquid from the high pressure receiver 110 in line 124 is sent to a stripper 126.

Most of the C_2^- is removed in the overhead of the stripper 126 and returned to line 106 via overhead line 108. A liquid bottoms stream from the stripper 126 is sent to a debutanizer

10 column 130 via line 128. An overhead stream in line 132 from the debutanizer comprises C_3 - C_4 olefinic product while a bottoms stream in line 134 comprising stabilized gasoline may be further treated and sent to gasoline storage.

[0023] A selected product stream line, preferably line 122 comprising the secondary absorber off-gas containing dry gas may be introduced into an amine absorber unit 140. A

15 lean aqueous amine solution is introduced via line 142 into absorber 140 and is contacted with the flowing dry gas stream to absorb hydrogen sulfide, and a rich aqueous amine

absorption solution containing hydrogen sulfide is removed from absorption zone 140 via line 144 and recovered. A selected product stream line preferably comprising a dry gas stream

having a reduced concentration of hydrogen sulfide is removed from absorption zone 140 via

20 line 146. Any of lines carrying product from the FCC reactor 12 including lines 114 or 122 and 146 may serve as selected product lines in communication with the downstream power recovery section 60 to transport a selected product stream from the gas recovery section 120 of the product recovery section 90 to the power recovery section 60. Additionally, dry gas may be delivered to the power recovery section 60 from any other source in the refinery 100

25 such as a coker unit or a steam cracker unit.

[0024] The selected FCC product gas from the product recovery section 90 in line 146 can be used in the power recovery section 60 in a continuous process and in the same refinery complex. The power recovery section 60 is in downstream communication with the vapor recovery section of the product recovery section 90 via line 146. As an alternative to sending
30 the selected gas in line 146 to the refinery fuel gas header, the selected product gas may be let down in pressure at a volume increase across an expander 150 to recover pressure energy from the gas. The selected gas is still at the high pressure utilized in the vapor recovery

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section 120 of the product recovery section 90 when delivered to the expander 150 due to operation of the compressor 104. The selected gas exits expander 150 in exhaust line 152. The expander is connected by a shaft 154 to an electrical generator 78 for generating electrical power that can be used in the refinery or exported. Beside connection by shaft 154 to the electrical generator, the expander 150 may alternatively or additionally be connected by a shaft (not shown) to the main air blower 50 for blowing air to the regenerator 14 obviating the need for driver 52. A gear reducer may be provided on the shaft 154 between the expander 150 and the generator 78 in which case the gear reducer (not shown) would connect two shafts of which shaft 154 is one. The expander 150 may be in downstream communication with the selected product line 146 and with vapor recovery section 120 of the product recovery section 90 via line 146.

[0025] It is also contemplated that an additional steam expander (not shown) may be connected by an additional shaft or the same shaft 154 to further turn electrical generator 78 and produce additional electrical power or power the main air blower 50. The additional steam expander would be fed by surplus steam in the refinery. The additional expander could be either an extraction or induction turbine. In the latter case, the additional expander could take the form of an additional chamber in expander 150 or 70 with the surplus steam feeding the additional chamber (not shown). The additional expander may be coupled by a gear reducer (not shown) to the additional shaft or the same shaft 154. It is also contemplated that expanders 70 and 150 could be the same expander with induction feed from line 82, 54 or 146, respectively, introducing a stream to an intermediate chamber of the expander.

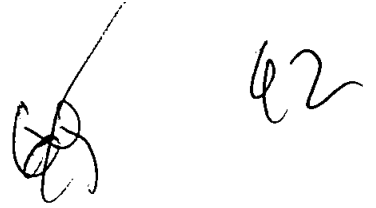
[0026] The selected product gas may be used as a flue gas reheating media. Selected product lines 116, 122, 146 and/or 152 communicate the product recovery section 90 with a downstream flue gas heater 156. After, before or instead of power recovery in expander 150 from the selected gas, the selected gas is routed to the flue gas heater 156 in expander exhaust line 152 if the expander 150 is utilized. For example, steam generation in the upstream flue gas power recovery section 60 may have allowed for the majority of the flue gas system to be designed of lower class metallurgy. While this can dramatically reduce the total installed cost of the flue gas power recovery system, it can also reduce the power generation capability across the flue gas expander 70. To regain the electrical power generating capability of the flue gas, selected gas from the product recovery section 90 and suitably from the gas recovery section 120 can be used to re-heat the flue gas on temperature control to a maximum



permissible inlet temperature of the expander 70. An oxygen-containing gas such as air may be added to the selected product stream in exhaust line 152 from line 158. The oxygen and the selected gas are ignited continuously to combust the selected gas in the flue gas heater 156 and achieve an elevated temperature. The flue gas heater 156 may be in downstream communication with the expander 150.

[0027] In the embodiment of FIG. 1, combust line 160 communicates with and carries hot combusted selected product gas to join line 82 carrying flue gas downstream from the regenerator 14, thus raising the temperature of the flue gas in flue gas line 82 on entering combine line 54. Combust line 160 may deliver hot combusted selected product gas to combine with flue gas stream in flue gas line 82 in downstream communication with the flue gas outlet 47 to line 48 to provide a combined selected product and flue gas stream in combine line 54. Combine line 54 is in downstream communication with the flue gas line 82 and the combust line 160. Combine line 54 communicates lines 82 and 160 with the downstream expander 70. The combine stream of at least a portion of the combusted selected product gas stream with at least a portion of a flue gas stream of elevated temperature are then carried to the expander 70 in line 54 at a higher temperature than in line 82 to produce an even greater quantity of power in the expansion. The expander 70 is in downstream communication with the selected product line 146 and with vapor recovery section 120 of the product recovery section 90 and with line 152. The expander 70 is also in downstream communication with the flue gas heater 156 via lines 160 and 54.

[0028] This arrangement is economically attractive as it may maximize utilization of existing assets, but it also allows for the burning of olefin rich dry gas from the FCC reactor 12 or other reactor in which hydrogen is deficient, which is not viable for use in gas turbines in which the olefins can cause internal fouling. The reheated flue gas is processed through the expander 70 for maximum power generation. The outlet line 86 from the expander 70 communicates with a downstream heat exchanger 61 which may be a steam generator via line flue gas lines 69 and 67. The heat exchanger 61 is in downstream communication with the expander 70. The heat exchanger 61 is also in downstream communication with the flue gas heater 156 via lines 160, 54, 86, 69 and 67. The residual heat energy may be recovered by directing the combined selected product and flue gas stream in line 86 to the downstream flue gas cooler 61 via lines 66 and 67. In the flue gas cooler 61, heat exchange media is heat exchanged with the combine stream preferably for steam generation. The power generation

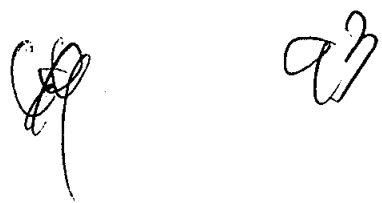


capacity of the flue gas in expander 70 may increase by a factor of 1.8 to 2.2 by combining combusted selected product gas from combust line 160 with the flue gas stream in line 82. The selected product gas may be used to reheat the flue gas whether or not it is routed through expander 150, but prior recovery of the pressure energy may be preferable.

5 [0029] FIG. 2 shows an alternative embodiment in which most elements are the same as in FIG. 1 indicated by like reference numerals but with differences in configuration indicated by designating the reference numeral with a prime symbol (""). The combust line 160' from the flue gas heater communicates with a downstream heat exchanger 61, preferably a steam generator, via a combine line 56. Line 160' feeds combusted selected product gas to join
10 waste flue gas line 67 carrying flue gas downstream of the flue gas outlet 47 of the regenerator 14 to provide a combined combusted selected product and flue gas stream in combine line 56. Line 67 is in downstream communication with the turbine exhaust line 86. Combine line 56 carries the combined selected product and flue gas stream at a higher temperature than the flue gas in waste flue gas line 67 to the flue gas cooler heat exchanger
15 61 to obtain an even greater heat exchange or recovery of high quality steam. Combine line 56 is in downstream communication with combust line 160' and flue gas line 67. The heat exchanger 61 is in downstream communication with the flue gas heater 156 and lines 160' and 56. It is also contemplated that exhaust line 160' feed lines 48 or 66 to immediately improve steam generation in downstream steam generators 62 or 63, respectively. Therefore,
20 if a refiner has a greater demand for steam than for power, the embodiment of FIG. 2 may be more advantageous than that of FIG. 1.

EXAMPLE

[0030] For example, per the following data inputs and calculated output, the dry gas production from an FCC unit would be used to generate a rather substantial 2.05 MW through
25 an expander.



Dry Gas Stream Property		
Mass flow rate	69380 kg/hr	152,636 lb/hr
Pressure to expander inlet	13.2 kg/cm ² g	202.4 psia
Pressure from expander outlet	2.5 kg/cm ² g	50.26 psia
Temperature at expander inlet	38°C	100°F
Molecular weight	21.7	
UOP K value	1.22	
Critical temperature	427°C	801°F
Critical Pressure	687 kg/cm ² g	9771 psia

[0031] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. It should be understood that the illustrated embodiments are exemplary only, and should not be taken as limiting the scope of the invention.

CLAIMS:

1. An apparatus for processing streams from a fluid catalytic cracking unit comprising:

a fluid catalytic cracking reactor for contacting cracking catalyst with a hydrocarbon
5 feed stream to crack the hydrocarbons to gaseous product hydrocarbons having
lower molecular weight and deposit coke on the catalyst to provide coked catalyst;
a product outlet for discharging said gaseous product hydrocarbons from said reactor;
a regenerator for combusting coke from said coked catalyst by contact with oxygen;
a flue gas outlet for discharging flue gas from said regenerator;
10 a product recovery section in downstream communication with said product outlet,
said product recovery section for separating said gaseous products into a plurality
of product streams including a selected product stream;
a power recovery section in downstream communication with said flue gas outlet; and
said power recovery section in downstream communication with said product
15 recovery section.

2. The apparatus of claim 1 wherein a selected product line communicates said
product recovery section with a downstream flue gas heater in which the selected product gas
is combusted with oxygen and a combust line communicates said flue gas heater with said
flue gas line.

3. The apparatus of claim 2 wherein a combine line in downstream communication
with said combust line and said flue gas line communicates with a downstream expander for
power recovery.

4. The apparatus of claim 3 wherein said expander is coupled to an electrical
generator.

5. The apparatus of claim 2 wherein a combine line in downstream communication
with said combust line and said flue gas line communicates with a downstream heat
exchanger.

6. The apparatus of claim 5 wherein said downstream heat exchanger generates
steam.

7. The apparatus of claim 2 wherein an expander in said power recovery section is in
downstream communication with said selected product line, and a flue gas heater is in
downstream communication with said selected product line.

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8. The apparatus of claim 1 wherein an expander in said power recovery section is in downstream communication with a selected product line transporting said selected product stream.

9. The apparatus of claim 8 wherein a flue gas heater, in which said selected product stream is combusted with oxygen, is in downstream communication with said expander.

10. The apparatus of claim 9 wherein a second expander is in downstream communication with said flue gas heater.

11. The apparatus of claim 10 wherein a heat exchanger is in downstream communication with said second expander

12. The apparatus of claim 10 wherein a heat exchanger is in downstream communication with said flue gas heater.

13. The apparatus of claim 10 wherein a heat exchanger is in downstream communication with said flue gas heater for steam generation.

14. An apparatus for processing a flue gas stream from a fluid catalytic cracking unit comprising:

- a fluid catalytic cracking reactor for contacting cracking catalyst with a hydrocarbon feed stream to crack the hydrocarbons to gaseous product hydrocarbons having lower molecular weight and deposit coke on the catalyst to provide coked catalyst
- a product outlet for discharging said gaseous product hydrocarbons from said reactor;
- a regenerator for combusting coke from said coked catalyst by contact with oxygen;
- a flue gas outlet for discharging flue gas from said regenerator;
- a source of dry gas;
- a power recovery section in downstream communication with said flue gas outlet;
- a flue gas heater in downstream communication with said source of dry gas; and
- said power recovery section in downstream communication with said flue gas heater.

15. The apparatus of claim 14 wherein an expander is in downstream communication with a combine line in downstream communication with said flue gas heater and said flue gas outlet.

16. The apparatus of claim 15 wherein said expander is coupled to an electrical generator.

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17. The apparatus of claim 14 wherein a steam generator is in downstream communication with a combine line which is in downstream communication with said flue gas heater and said flue gas outlet.

18. An apparatus for processing streams from a fluid catalytic cracking unit comprising:

- a fluid catalytic cracking reactor for contacting cracking catalyst with a hydrocarbon feed stream to crack the hydrocarbons to gaseous product hydrocarbons having lower molecular weight and deposit coke on the catalyst to provide coked catalyst;
- a product outlet for discharging said gaseous product hydrocarbons from said reactor;
- a regenerator for combusting coke from said coked catalyst by contact with oxygen;
- a flue gas outlet for discharging flue gas from said regenerator;
- a product recovery section in downstream communication with said product outlet for separating said gaseous products into a plurality of product streams including a selected product stream;
- a power recovery section in downstream communication with said flue gas outlet;
- an expander in said power recovery section in downstream communication with said product recovery section; and
- a flue gas heater in downstream communication with said expander for combusting said selected product stream with oxygen.

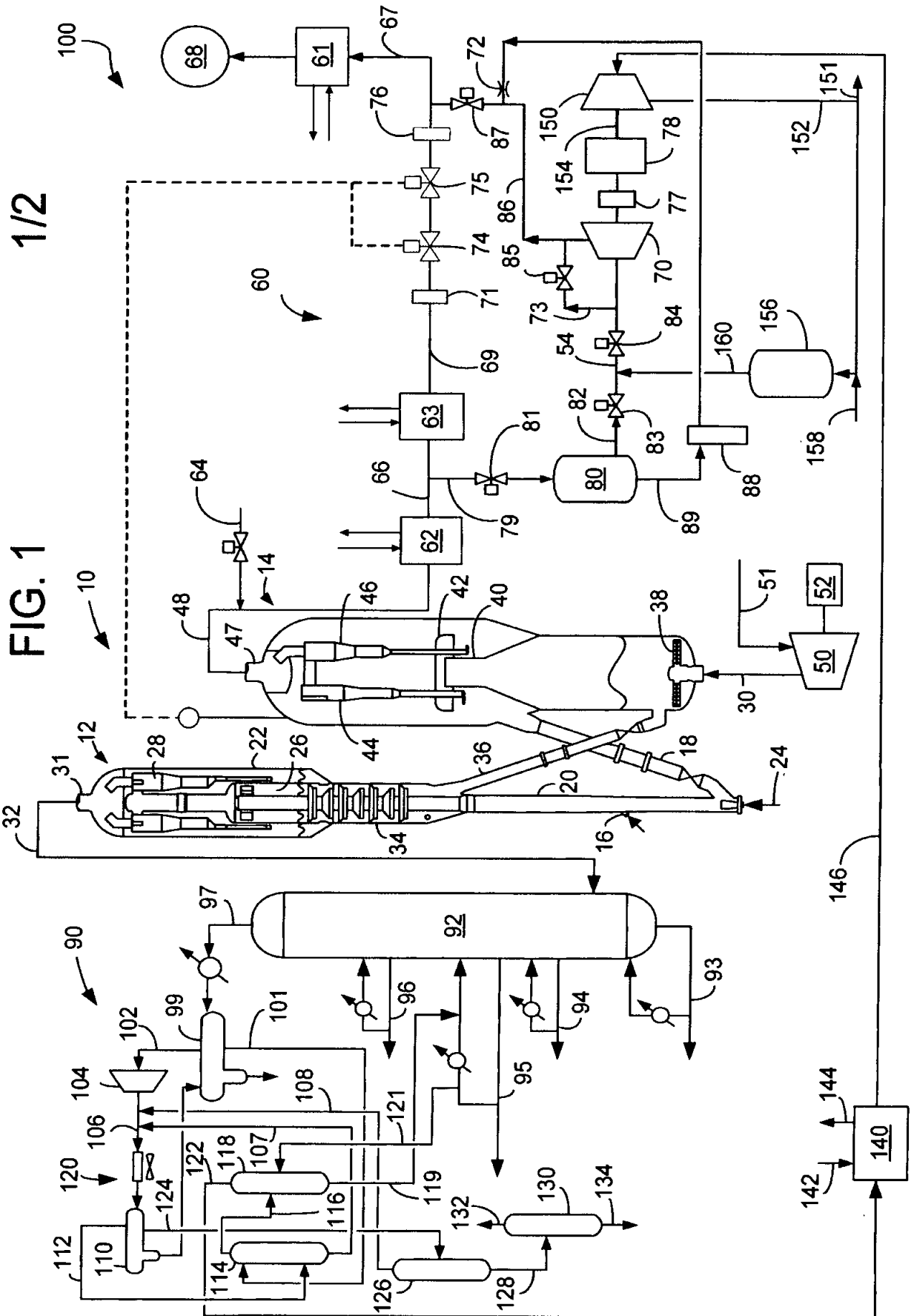
19. The apparatus of claim 18 wherein a second expander is in downstream communication with said flue gas heater and said flue gas outlet for power recovery.

20. The apparatus of claim 18 wherein a heat exchanger is in downstream communication with said flue gas heater and said flue gas outlet.

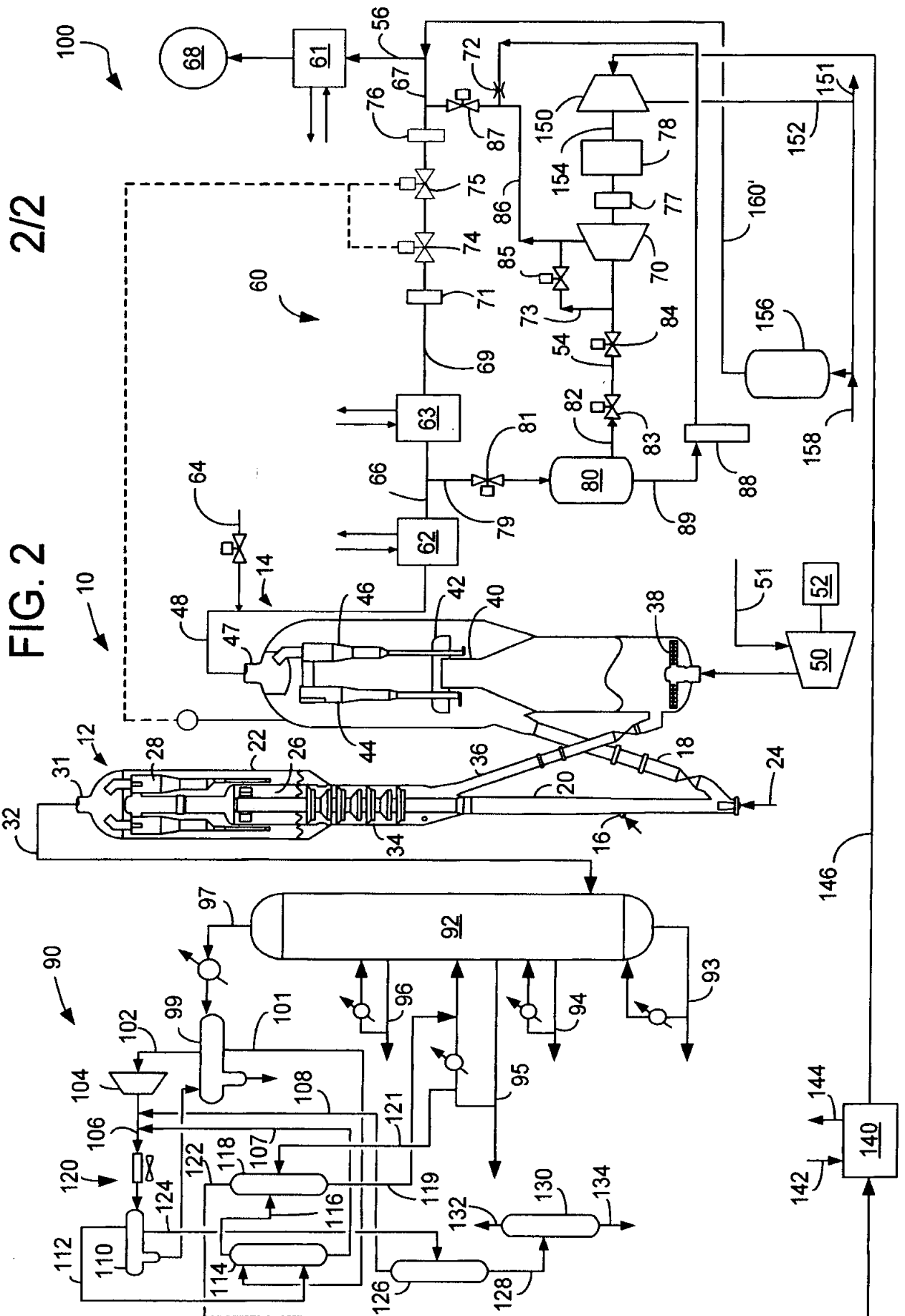
ABSTRACT

Disclosed is an apparatus for recovering power from an FCC product. The dry gas is combusted and combined with FCC regenerator flue gas to raise the power recovery capability of the flue gas. The flue gas can be used to generate electrical power or steam.

- 5 Alternatively or additionally, dry gas from an FCC product stream is separated and delivered to an expander to recover power before combustion.



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TRADUCCIÓN DEL INGLÉS AL ESPAÑOL del documento de prioridad relacionado con la Solicitud de Patente de los Estados Unidos de América No. 11/832,143 titulada:

APARATO PARA RECUPERAR ENERGÍA DE UN PRODUCTO FCC

ANEXOS. La solicitud de Patente de los Estados Unidos No. 11/832,143 arriba mencionada y Certificación del Comisionado de Patentes y Marcas de los Estados Unidos.

LOS ESTADOS UNIDOS DE AMÉRICA
A TODO AQUEL QUE PUEDA LLEGARLE LA PRESENTE:

DEPARTAMENTO DE COMERCIO DE ESTADOS UNIDOS
Oficina de Marcas y Patentes de Estados Unidos

Julio 28, 2008

ESTE ES PARA CERTIFICAR QUE EL ANEXO ES UNA COPIA VERDADERA DE LOS ARCHIVOS DE LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS DE TALES DOCUMENTOS DE LA SOLICITUD PARA PATENTE IDENTIFICADA ABAJO LA CUAL CUMPLIÓ CON LOS REQUERIMIENTOS PARA OTORGARSELE UNA FECHA DE PRESENTACION BAJO 35 USC 111

NUMERO DE SOLICITUD: 11/832,143

FECHA DE PRESENTACIÓN: Agosto 1, 2007

EL CODIGO DE PAIS Y NUMERO DE PRIORIDAD DE LA SOLICITUD PARA SER UTILIZADOS EN LA PRESENTACIÓN EN EL EXTERIOR BAJO LA CONVENCION DE PARIS ES US11/832,143

Por autoridad del

Subsecretario de Comercio para la Propiedad Intelectual

y Director de la Oficina de Marcas y Patentes de Estados Unidos

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REIVINDICACIONES:

1. Un aparato para procesar flujos de una unidad de craqueo de fluido catalítico que comprende:

Un reactor de craqueo de fluido catalítico para contactar el catalizador de craqueo con un flujo alimentado de hidrocarburo para craquear los hidrocarburos a hidrocarburos de producto gaseosos que tienen bajo peso molecular y coque de depósito para en el catalizador para proveer catalizador coqueado;

Una salida de producto para descargar los mencionados hidrocarburos de producto gaseosos del mencionado reactor;

Un regenerador para el coque de combustión del mencionado catalizador coqueado mediante contacto con oxígeno;

Una salida de gas de combustión para descargar gas de combustión del mencionado regenerador;

Una sección de recuperación de producto en comunicación hacia abajo con la mencionada salida de producto, la mencionada sección de recuperación para separar los mencionados productos gaseosos en una pluralidad de flujos de productos incluyendo un seleccionado flujo de producto;

Una sección de recuperación de poder en comunicación hacia abajo con la mencionada salida de gas de combustión; y la mencionada sección de recuperación de poder en comunicación hacia abajo con la mencionada sección de recuperación de producto.

2. El aparato de la reivindicación 1 en donde una línea de producto seleccionado comunica la mencionada sección de recuperación de producto con un calentador de gas de combustión abajo en el cual el seleccionado producto de gas es quemado con oxígeno y una línea de combustión comunica el mencionado calentador de gas de combustión con la mencionada línea de gas de combustión.

3. El aparato de la reivindicación 2 en donde se combina una línea de comunicación hacia abajo con la mencionada línea de combustión y la mencionada línea de gas de combustión comunica con un extensor hacia abajo para la recuperación de poder.

4. El aparato de la reivindicación 3 en donde el mencionado extensor está acoplado a un generador eléctrico.

5. El aparato de la reivindicación 2 en donde se combina una línea de comunicación hacia abajo con la mencionada línea de combustión y la mencionada línea de gas de combustión comunica con un intercambiador de calor hacia abajo.

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6. El aparato de la reivindicación 5 en donde el mencionado intercambiador de calor hacia abajo genera vapor.

7. El aparato de la reivindicación 2 en donde un extensor en la mencionada sección de recuperación de poder está en comunicación hacia abajo con la mencionada línea de producto seleccionado, y un calentador de gas de combustión está en comunicación hacia abajo con la mencionada selección de línea de producto seleccionado.

8. El aparato de la reivindicación 1 en donde un extensor en la mencionada sección de recuperación de poder está en comunicación hacia abajo con una línea de producto seleccionado transportando el mencionado flujo de producto seleccionado.

9. El aparato de la reivindicación 8 en donde un calentador de gas de combustión, en el cual el mencionado flujo de producto seleccionado es quemado con oxígeno, esta en comunicación hacia abajo con el mencionado extensor.

10. El aparato de la reivindicación 9 en donde una segundo extensor está en comunicación hacia abajo con el mencionado calentador de gas de combustión.

11. El aparato de la reivindicación 10 en donde un intercambiador de calor está en comunicación hacia abajo con el mencionado segundo extensor.

12. El aparato de la reivindicación 10 en donde un intercambiador de calor está en comunicación hacia abajo con el mencionado calentador de gas de combustión.

13. El aparato de la reivindicación 10 en donde un intercambiador está en comunicación hacia abajo con el mencionado calentador de gas de combustión para la generación de vapor.

14. Un aparato para el procesamiento de un flujo de gas de combustión desde una unidad de craqueo de fluido catalítico que comprende:

Un reactor de craqueo de fluido catalítico para contactar el catalizador craqueado con un flujo alimentador de hidrocarburo para craquear los hidrocarburos a hidrocarburos de producto gaseosos que tienen bajo peso molecular y coque de depósito en el catalizador para proveer catalizador coqueado;

Una salida de producto para descargar los mencionados hidrocarburos de producto gaseosos del mencionado reactor;

Un regenerador para quemar coque del mencionado catalizador coqueado mediante contacto con oxígeno;

Una salida de gas de combustión para descargar gas de combustión del mencionado regenerador;

Una fuente de gas seco;

Una sección de recuperación de poder en comunicación hacia abajo con la mencionada salida de gas de combustión.

Un calentador de gas de combustión en comunicación hacia abajo con la mencionada fuente de gas seco; y

Mencionada sección de recuperación de poder en comunicación hacia abajo con el mencionado calentador de gas de combustión.

15. El aparato de la reivindicación 14 donde un extensor está en comunicación hacia abajo con una línea combinada en comunicación hacia abajo con la mencionada salida de gas de combustión.

16. El aparato de la reivindicación 15 en donde el mencionado extensor está acoplado a un generador eléctrico.

17. El aparato de la reivindicación 14 en donde un generador de vapor está en comunicación hacia abajo con una línea combinada la cual está en comunicación hacia abajo con el mencionado calentador de gas de combustión y la mencionada salida del gas de combustión.

18. Un aparato para procesar flujos desde una unidad de craqueo de fluido catalítico que comprende:

Un reactor para craqueo de fluido catalítico para contactar el catalizador de craqueo con un flujo alimentador de hidrocarburo para craquear los hidrocarburos a hidrocarburos de producto gaseosos que tienen bajo peso molecular y coque depósito en el catalizador para proveer catalizador coqueado;

Una salida de producto para descargar los mencionados hidrocarburos de producto gaseosos del mencionado reactor;

Un regenerador para quemar coque del mencionado catalizador coqueado mediante contacto con oxígeno.

Una salida de gas de combustión para descargar gas de combustión del mencionado reactor;

Una sección de recuperación de producto en comunicación hacia abajo con la mencionada salida de producto para separar los mencionados productos gaseosos en una pluralidad de flujos de productos incluyendo un flujo de producto seleccionado;

Una sección de recuperación de poder en comunicación hacia abajo con la mencionada salida de gas de combustión;

Un extensor en la mencionada sección de recuperación de poder en comunicación hacia abajo con la mencionada sección de recuperación de producto, y

Un calentador de gas de combustión en comunicación hacia abajo con el mencionado extensor para combustión del mencionado flujo de producto seleccionado con oxígeno.

19. el aparato de la reivindicación 18 en donde un segundo extensor está en comunicación hacia abajo con el mencionado calentador de gas de combustión y la mencionada salida de gas de combustión para la recuperación de poder.

20. El aparato de la reivindicación 18 en donde un intercambiador de calor está en comunicación hacia abajo con el mencionado calentador de gas de combustión y la mencionada salida de gas de combustión.



2020
Bogotá D.C.,

Doctor(a)
CADENA SARMIENTO JUAN PABLO
Apoderado(a) y/o Representante de
UOP LLC

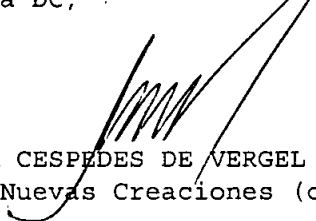
REFERENCIA	Radicación No. 08 79801
	Trámite 2
	Evento 1
	Actuación 416
	Oficio No. 9224
	Folios 1

Teniendo en cuenta que la solicitud de privilegio de patente que se tramita bajo el expediente indicado en la referencia, reúne los requisitos de forma establecidos en los artículos 26 y 27 de la Decisión 486 de la Comisión de la Comunidad Andina, y en las demás disposiciones vigentes sobre la materia, se envía el extracto de la solicitud a la Oficina de Comunicaciones para efecto de su publicación en la Gaceta de Propiedad Industrial.

De acuerdo con lo previsto por el artículo 40 de la Decisión 486/00, la publicación en este caso se hará a partir del día 09 del mes de noviembre de 2009.

Cúmplase
Dado en Bogotá DC,

10 NOV. 2009


ALIX CARMENZA CESPEDES DE VERGEL
Directora de Nuevas Creaciones (c)

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