



SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 11-093374- -00001-0000

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Tra. 2 PATENTES Eve: 1 REGDEPOSITO
Act. 329 CTQINFORMACION Folios: 43

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

Dirección de Nuevas Creaciones

E. S. D.

Asunto	NÚMERO DE RADICACIÓN	11-93374
Trámite	PATENTES DE INVENCION	
Actuación	COMPLEMENTO DE INFORMACIÓN	
Título	SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS	
Solicitante	JOSÉ ARMANDO BOHÓRQUEZ CORTÁZAR Y OTROS	

MAURICIO PINZÓN PINZÓN, identificado con la cédula de ciudadanía No. 79.145.527 de Usaquén, procedo a presentar el presente COMPLEMENTO DE INFORMACIÓN

1. Copia certificada de la solicitud de la patente SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS en Estados Unidos de América.
2. Poderes conferidos por los inventores.

Atentamente,


MAURICIO PINZÓN PINZÓN
C.C. No. 79.145.527 de Usaquén
T.P. No. 37.242 del C. S. de la J.

LFPF

2

Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.

JAIRO LEÓN RESTREPO VELÁSQUEZ mayor de edad, domiciliado en Itagüí, identificado con la Cédula de Ciudadanía 71.609.779 de Medellín, Antioquia por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS.**

El (los) apoderado(s) queda(n) facultado(s) para el cabal cumplimiento del presente poder, para efectuar las solicitudes, adelantar los trámites, recibir las notificaciones, interponer los recursos que sean procedentes y en general realizar las actividades conducentes al cumplimiento de la labor encomendada.

Este poder conlleva todas las facultades del mandato, incluidas las de sustituir y reasumir. En consecuencia, solicito reconocerle(s) personería.

El Poderdante:

Jairo Restrepo V.

JAIRO LEÓN RESTREPO VELÁSQUEZ
C.C. No. 71.609.779 de Medellín

Acepto,

MAURICIO PINZÓN PINZÓN

C.C. No. 79.145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCÍA CHACÓN

C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN

C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.

25 AGO 2011

NOTARIA 22

DILIGENCIA DE RECONOCIMIENTO
Y DE PRESENTACIÓN PERSONAL

Se presentó(aron) ante mí, EL NOTARIO VEINTIDÓS
DEL CÍRCULO DE MEDELLÍN, el Sr(es):

Jairo Restrepo Belasque

Identificado con C.C. N°(s)
7609779

Y manifestó(aron) que el contenido del documento
que antecede es cierto: que la(s) firmas que en él
aparece(n) es(son) suya(s) y para constancia se

firma: Jairo Restrepo V.

Medellín: 27 JUL 2011



Señor.

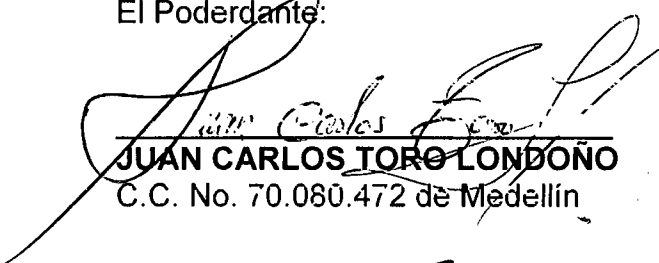
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.

JUAN CARLOS TORO LONDOÑO mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 70.080.472 de Medellín, Antioquia por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.

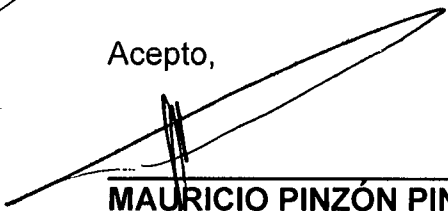
El (los) apoderado(s) queda(n) facultado(s) para el cabal cumplimiento del presente poder, para efectuar las solicitudes, adelantar los trámites, recibir las notificaciones, interponer los recursos que sean procedentes y en general realizar las actividades conducentes al cumplimiento de la labor encomendada.

Este poder conlleva todas las facultades del mandato, incluidas las de sustituir y reasumir. En consecuencia, solicito reconocerle(s) personería.

El Poderdante:


JUAN CARLOS TORO LONDOÑO
C.C. No. 70.080.472 de Medellín

Acepto,


MAURICIO PINZÓN PINZÓN
C.C. No. 79.145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCIA CHACÓN
C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN
C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.

PRESENTACIÓN PERSONAL

NOTARIA DIECINUEVE DEL CÍRCULO DE MEDELLÍN

Este memorial dirigido a:

fue presentado personalmente ante el suscrito NOTARIO por:

Identificado(s) con C.C. N°(s) de la Cédula de Ciudadanía de Medellín (Ante)

Medellín,

CARLOS JAVIER PALACIOS CALLE

23 AGO 2011



4

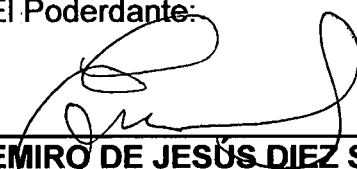
Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.

EMIRO DE JESÚS DIEZ SALDARRIAGA mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 8.342.796 de Envigado, Antioquia, por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS.**

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El Poderdante:


EMIRO DE JESÚS DIEZ SALDARRIAGA
C.C. No. 8.342.796 de Envigado.

Acepto,


MAURICIO PINZÓN PINZÓN
C.C. No. 79.145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCIA CHACÓN
C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN
C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.

Andrés Emiro Diez R
CC 93670424

25 AGO 2011

NOTARIA QUINTA DEL CIRCULO DE MEDELLIN

Este memorial dirigido a: Superintendencia Industrial y Comercio

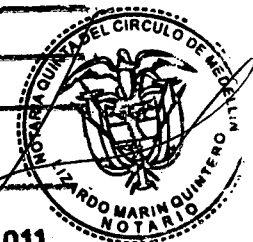
Fue presentado personalmente ante la suscrita NOTARIA por:

Andrés Emilio Díez Restrepo

Identificado(a) con cédula (s) No.(s) 98670424

Medellín

Andrés Emilio Díez R.



19 AGO. 2011

NOTARIA QUINTA DEL CIRCULO DE MEDELLIN

Este memorial dirigido a: Superintendencia Industrial y Comercio

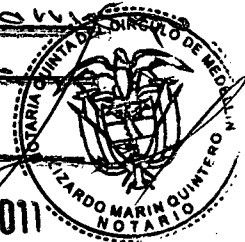
Fue presentado personalmente ante la suscrita NOTARIA por:

Emilio de Jesús Díez Saldarriaga

Identificado(a) con cédula (s) No.(s) B. 342496

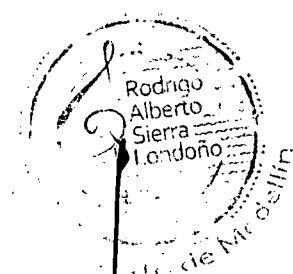
Medellín

[Signature]



19 AGO. 2011

Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.



HÉCTOR DIEGO GONZÁLEZ SÁNCHEZ mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 79'651.724 de Bogotá D.C. por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.

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El Poderdante:

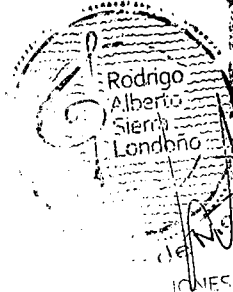
HÉCTOR DIEGO GONZÁLEZ SÁNCHEZ
C.C. No. 79'651.724 de Bogotá D.C.

Acepto,

MAURICIO PINZÓN PINZÓN
C.C. No. 79'145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCÍA CHACÓN
C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN
C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.



NOTARIA SEXTA DEL CÍRCULO DE MEDELLÍN

Este memorial dirigido a Superintendencia de Industria y Comercio

fue presentado personalmente ante el suscrito NOTARIO por Héctor Diego González Sánchez

Identificado(s) con cédula(s) y T.P. 79'651.724

de Medellín

25 JUL 2011

25 AGO 2011

6

Señor.

**SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.**

ANDRÉS EMIRO DIEZ RESTREPO mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 98.670.424 de Envigado, Antioquia por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.

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El Poderdante:

Andrés Emiro Diez R.

ANDRÉS EMIRO DIEZ RESTREPO

C.C. No. 98.670.424 de Envigado

Acepto,



MAURICIO PINZÓN PINZÓN

C.C. No. 79.145.527 de Usaquén

T.P. No. 37.230 del C.S. de la J.

SILVIA GARCIA CHACÓN

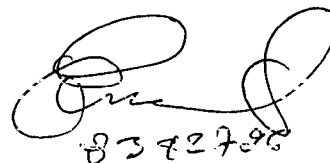
C.C. No. 52.414.738 de Bogotá

T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN

C.C. 52.831.150 De Bogotá D.C.

T.P. N° 169.853 del C.S. de la J.



8372796

25 AGO 2011

NOTARIA QUINTA DEL CIRCULO DE MEDELLIN

Este memorial dirigido a: Superintendente Industria y Comercio

Fue presentado personalmente ante la suscrita NOTARIA por:

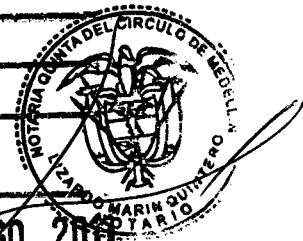
Andrés Emilio Díaz Restrepo

Identificado(a) con cédula (s) No.(s) 98670424

Medellín

Andrés Emilio Díaz R.

19 A60. 2011



NOTARIA QUINTA DEL CIRCULO DE MEDELLIN

Este memorial dirigido a: Superintendente Industria y Comercio

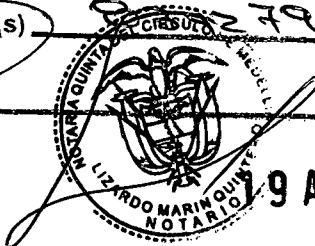
Fue presentado personalmente ante la suscrita NOTARIA por:

Emilio de Jesús Díaz Saldamando

Identificado(a) con cédula (s) No.(s) 92796

Medellín

[Signature]



19 A60. 2011

Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.



GABRIEL JAIME LÓPEZ JIMÉNEZ mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 71'317.381 de Medellín, Antioquia, por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.

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Este poder conlleva todas las facultades del mandato, incluidas las de sustituir y reasumir. En consecuencia, solicito reconocerle(s) personería.

El Poderdante:

GABRIEL JAIME LÓPEZ JIMÉNEZ
C.C. No. 71'317.381 de Medellín.

Acepto,

MAURICIO PINZÓN PINZÓN
C.C. No. 79'145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCIA CHACÓN
C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

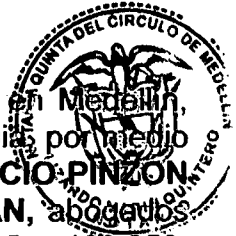
JULIANA ORDUZ BELTRÁN
C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.

25 AGO 2011

8

Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.

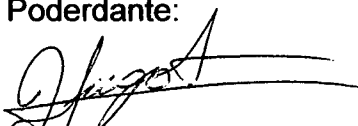
HUGO ALBERTO CARDONA RESTREPO mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 71'759.374 de Medellín, Antioquia, por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, apoderados, identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.



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El Poderdante:


HUGO ALBERTO CARDONA RESTREPO
C.C. No. 71'759.374 de Medellín.

Acepto,


MAURICIO PINZÓN PINZÓN
C.C. No. 79'145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCIA CHACÓN
C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN
C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.

25 AGO 2011.

COMPARECÍON (CIERON) ANTE MI LIZARDO DE JESUS MARIN QUINTERO
NOTARIO QUINTO

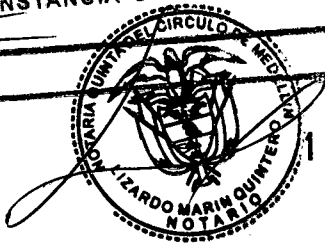
DEL CIRCULO DE MEDELLIN, EL SR(ES):

Hugo Alberto Cardona Restrepo

PORTADOR(ES) DE LA(S) CEDULA(S) No. (S) Fl. 759.374

Y MANIFESTARON QUE EL CONTENIDO DEL
DOCUMENTO QUE ANTECEDE ES CIERTO QUE LAS FIRMAS
QUE EN EL APARECEN, SON POR EL (ELLOS) Y
LAS MISMAS QUE USAN EN TODOS SUS ACTOS PUBLICOS Y
PRIVADOS. PARA CONSTANCIA SE FIRMA.

[Firma]
MEDELLIN



18 AGO. 2011

9

Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.



IDI AMIN ISAAC MILLÁN mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 71'788.496 de Medellín, Antioquia, por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN** y/o **SILVIA GARCÍA CHACÓN** y/o **JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.

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El Poderdante:

IDI AMIN ISAAC MILLÁN
C.C. No. 71'788.496 de Medellín.

Acepto,

MAURICIO PINZÓN PINZÓN
C.C. No. 79'145.527 de Usaquén
T.P. No. 37.230 del C.S. de la J.

SILVIA GARCIA CHACÓN
C.C. No. 52.414.738 de Bogotá
T.P. No. 101.695 del C.S. de la J.

JULIANA ORDUZ BELTRÁN
C.C. 52.831.150 De Bogotá D.C.
T.P. N° 169.853 del C.S. de la J.

25 AGO 2011

COMPARECÍO(CIERON) ANTE MI LIZARDO DE JESUS MARIN QUINTERO
NOTARIO QUINTO

DEL CIRCULO DE MEDELLIN, EL SR(ES):

IDI Amin Isaac Millan

PORTADOR(ES) DE LA(S) CEDULA(S) No. (S) 71-788-496

Y MANIFIESTA QUE EL CONTENIDO DE
DOCUMENTO QUE ANTECEDE ES CIERTO QUE LAS FIRMS
QUE EN EL APARECEN, SON POR EL (ELLO)
LAS MISMAS QUE USAN EN TODOS SUS ACTOS PUBLICOS
PRIVADOS. PARA CONSTANCIA SE FIRMA



Millan
MEDELLIN

10

Señor.
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO.
DIVISION DE NUEVAS CREACIONES
E.S.D.

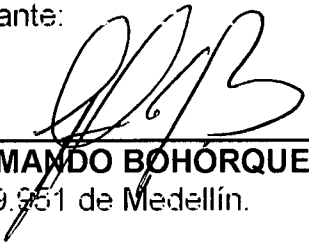
JOSÉ ARMANDO BOHÓRQUEZ CORTAZAR mayor de edad, domiciliado en Medellín, identificado con la Cédula de Ciudadanía 71.659.951 de Medellín, Antioquia por medio del presente escrito confiero poder especial, amplio y suficiente a **MAURICIO PINZÓN PINZÓN y/o SILVIA GARCÍA CHACÓN y/o JULIANA ORDUZ BELTRÁN**, abogados identificados con las tarjetas profesionales Nos. 37.230, 101.695, 169.853, respectivamente, para que presenten, en forma individual o conjunta, en mi nombre, solicitud de Patente de Invención Nacional titulada **SISTEMA DE CONTROL DE ENVEJECIMIENTO DE DEVANADOS ELÉCTRICOS**.



El (los) apoderado(s) queda(n) facultado(s) para el cabal cumplimiento del presente poder, para efectuar las solicitudes, adelantar los trámites, recibir las notificaciones, interponer los recursos que sean procedentes y en general realizar las actividades conducentes al cumplimiento de la labor encomendada.

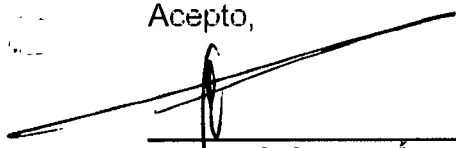
Este poder conlleva todas las facultades del mandato, incluidas las de sustituir y reasumir. En consecuencia, solicito reconocerle(s) personería.

El Poderdante:



JOSÉ ARMANDO BOHÓRQUEZ CORTAZAR
CC 71.659.951 de Medellín.

Acepto,



MAURICIO PINZÓN PINZÓN
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25 AGO 2011

COMPARECÍO(CIERON) ANTE MI LIZARDO DE JESUS MARÍN QUINTERO
NOTARIO QUINTO

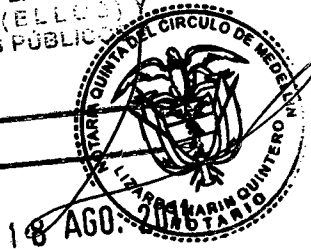
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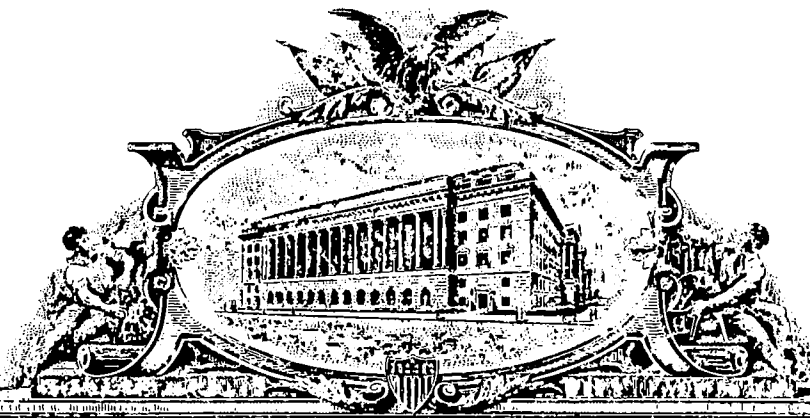
Jose Armando Bohorquez Cortazar

PORTADOR(ES) DE LA(S) CEDULA(S) No. (C) 71.659.951

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July 20, 2011

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

APPLICATION NUMBER: 12,845,776

FILING DATE: July 29, 2010

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US12/845,776

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




R. BLAKENEY
Certifying Officer

Electronic Acknowledgement Receipt

EFS ID:	8112493
Application Number:	12845776
International Application Number:	
Confirmation Number:	1639
Title of Invention:	SYSTEM FOR CONTROLLED AGING OF ELECTRICAL WINDINGS
First Named Inventor/Applicant Name:	Jose Armando Bohonquez
Customer Number:	63420
Filer:	John J. Martinez
Filer Authorized By:	
Attorney Docket Number:	016.001
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Filing Date:	
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Application Type:	Utility under 35 USC 111(a)

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Deposit Account	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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	Oath or Declaration filed		17	19	
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Information:					
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Warnings:					
Information:					
Total Files Size (in bytes):			621045		

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

SYSTEM FOR CONTROLLED AGING OF ELECTRICAL WINDINGS

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

0001. The present invention is related to a system that causes artificial aging of electrical windings, wherein the system is mostly applied as an accelerated thermal aging test on stator bars or stator windings of electric machines.

2. DESCRIPTION OF PRIOR ART

0001. Stator bar or stator windings of big synchronous machines or electric machines that are in continuous service are exposed to aging factors such as heat that deteriorate the insulating material gradually, and unless there is regular monitoring and maintenance, complete machine failures can occur. Failures of these machines are extremely costly.

0002. One monitoring system is the accelerated thermal aging of the stator bar wherein external heat is applied externally to the stator bar by means of an oven (see Electrical Insulation for Rotating Machines, Design, Evaluation, Testing and Repair, Stone, G.C. et al., page 59, IEEE Press Series on Power Engineering, Wiley-InterScience, 2004, ISBN 0-471-44506-1), or by means of a heating plate (see China Patent Publication No. 1402413A or 1162953C by HENGKUN, YUE XIE, Abstract).

0003. Applying heat externally or causing heat by conduction to the stator bar during the described accelerated thermal aging test has the limitation of no simulating how heat is generated in the stator bar during the normal operation of the electric machine. Under normal operation conditions of an electrical machine, the stator bar heat is generated internally by induction because of the electrical current passing through the internal conductive component of the stator bar.

0004. The present invention simulates how heat is generated in the stator bar when an electric machine is operating.

SUMMARY OF THE INVENTION

0005. The present invention provides system for testing an electrical winding element (a stator bar or a stator winding). The stator bar is attached to a short circuit conductive element to form a closed short circuit of a single turn that acts as a primary circuit. The closed short circuit is connected to a step-up transformer that will act as a secondary circuit and which has at least two turns. The step-up transformer uses a controlled variable voltage source that charges the closed short circuit. Charging the closed short circuit creates a current in the stator bar inner conductive element, causing heat on the stator bar by induction. The system of the present invention is suitable for an accelerated thermal aging test that simulates closely how heat is created by induction on stator bars of electric machines.

0006. Specifically the present invention provides a system for controlled accelerated aging of electrical windings, wherein the system comprises:

- A. An electrical winding element and a short circuit conductive element, wherein the electrical winding element has an inner conductive component and an insulation component; wherein each one of the two elements, the electrical winding element and the short circuit conductive element, have two ends, where the two ends of the electrical winding element are attached to the two ends of the short circuit conductive element by means of two connections, wherein the two attached elements, the electrical winding element and the short circuit conductive element, form a closed short circuit;
- B. A step-up transformer, wherein the step-up transformer uses a controlled variable voltage source, wherein the step-up transformer is connected to the closed short circuit, wherein the step-up transformer using a controlled variable voltage source, provides controlled variable charges to the closed short circuit;
- C. A reactive power compensation part wrapped around a section of the electrical winding element, wherein the reactive power compensation part has a shielding component and an wrapping component, wherein the shielding component is grounded, wherein the wrapping component is a non-magnetic, non-sparking component;

D. A capacitor device, wherein the capacitor device is and additional component connected to the other reactive power compensation part components;

wherein charging of the closed short circuit with a controlled charge by the step-up transformer using a controlled variable voltage source, induces heat in the inner conductive component of the electrical winding element, wherein cycles of controlled charges by the step-up transformer using a controlled variable voltage source, generate cycles of flowing current through the closed short circuit, wherein the cycles of flowing current through the closed short circuit produce cycles of heat by induction in the electrical winding element, wherein said cycles of heat produce aging in the insulating component.

0007. In a preferred embodiment of the system of the present invention, the electrical winding element is a stator bar.

0008. In one aspect of the preferred embodiment of the system of the present invention, the inner conductive component of the electrical winding element is made of copper.

0009. In another aspect of the preferred embodiment of the system of the present invention, the short circuit conductive element is made of copper.

0010. In an additional aspect of the preferred embodiment of the system of the present invention, the two connections, that attach into the closed short circuit the electrical winding element and the short circuit conductive element, are made of copper.

0011. In another aspect of the preferred embodiment of the system of the present invention, the shielding component of the reactive power compensation part is made of silicon steel iron.

0012. In a further aspect of the preferred embodiment of the system of the present invention, the wrapping component of the reactive power compensation part is made of aluminum.

0013. Additional objectives and advantages of the present invention will be more evident in the detailed description of the invention and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

0014. Figure 1 shows an illustration of the system of the present invention.

0015. Figure 2 shows a diagrammatic representation of a heat gradient on a multiple layered electrical winding element when heat is created by induction and by conduction.

0016. Figure 3 shows the system of the present invention preferred connection to attach the tested electrical winding element to a short circuit conductive element to form a closed short circuit.

0017. Figure 4 shows in more detail how the system of the present invention preferred connection attaches an end of

electrical winding element to an end of the short circuit conductive element.

DETAILED DESCRIPTION OF THE INVENTION

0018. **Figure 1** shows the system for controlled accelerated aging of electrical windings, wherein the system comprises:

- A. An electrical winding element (1) and a short circuit conductive element (2), wherein the electrical winding element (1) has an inner conductive component and an insulation component; wherein each one of the two elements (1 and 2), the electrical winding element (1) and the short circuit conductive element (2), have two ends (1E₁ 1E₂ and 2E₁ 2E₂), where the two ends (1E₁ 1E₂) of the electrical winding element (1) are attached to the two ends (2E₁ 2E₂) of the short circuit conductive element (2) by means of two connections (3) (**Figures 1, 3, and 4**), wherein the two attached elements (1 and 2), the electrical winding element (1) and the short circuit conductive element (2), form a closed short circuit;
- B. An step-up transformer (4), wherein the step-up transformer (4) uses a controlled variable voltage source, wherein the step-up transformer (4) is connected to the closed short circuit, wherein the step-up transformer (4) using a controlled variable voltage source, can provide controlled variable charges to the closed short circuit;

C. A reactive power compensation part (5) wrapped around a section of the electrical winding element (1), wherein the reactive power compensation part (5) has a shielding component and an wrapping component, wherein the shielding component is grounded, wherein the wrapping component is a non-magnetic, non-sparking component;

D. A capacitor device (6), wherein the capacitor device (6) is and additional component connected to the other reactive power compensation part components (5);

wherein charging of the closed short circuit with a controlled charge by the step-up transformer (4) using a controlled variable voltage source, induces heat in the inner conductive component of the electrical winding element (1), wherein cycles of controlled charges by the step-up transformer (4) using a controlled variable voltage source, generate cycles of flowing current (7) through the closed short circuit, wherein the cycles of flowing current (7) through the closed short circuit produce cycles of heat by induction in the electrical winding element (1), wherein said cycles of heat produce thermal aging in the insulating component.

0019. The step-up transformer (4) that uses a controlled variable voltage source acts as a secondary circuit, wherein the step up transformer (4) using a controlled variable voltage, simulate the charging cycles of real electrical machines or motors.

0020. For purposes of the present invention the step-up transformer is constituted by at least one transformer with

several turns, or more than one transformer connected in parallel, wherein the transformers connected in parallel have additive polarity to guarantee that the induction of current is additive. When the step up transformer is constituted by more than one transformer connected in parallel with additive polarity, the amount of transformer connected in parallel depends on the amount of current to be inducted , and the impedance of the electrical winding element (stator bar) to be tested, wherein the following formula has to be complied with:

$$I_2/N_1=I_1/N_2 \text{ or } I_2 \times N_2=I_1 \times N_1 \text{ if } N_2>N_1 \text{ then } I_1>I_2$$

0021. In the formula, I_1 is the current of the closed short circuit (primary circuit), I_2 is the current of the step-up transformer (secondary circuit), N_1 is the number of turns of the primary circuit, and N_2 is the number of turns of the secondary circuit. I_1 should compensate the motor-magnetic forces produced by the secondary circuits, and this is why I_1 has high values.

0022. Figure 2 shows a diagram illustrating a gradient of heat when heat is applied to a layered electrical winding element by induction (**Figure 2A**) and by conduction (**Figure 2B**). In **Figure 2**, $+T^\circ$ means the lowest heat, $++T^\circ$ means higher heat than $+T^\circ$, and successively until $+++++T^\circ$ means the highest heat. **Figure 2A** shows a gradient of heat from highest heat in the inner conductive component that is the most internal layer, to heat that is lower and lower toward the outside layers which are the insulating component. **Figure 2B** shows the opposite gradient of

highest heat in the most external layer to lowest heat in the most internal layer.

0023. It is important to mention that depending on the insulation component region that is deteriorated, the polarity of the predominant partial discharges changes. Therefore, the present invention system for accelerated thermal aging is adequate to find models that correlate indicator trends for partial discharges with levels of deterioration of the insulating component.

0024. The term electrical winding **(1)** element is synonymous with stator bar with one turn per bar, stator winding with just one turn, or any kind of electrical winding with just one turn in an electric machine or electric motor.

0025. In one aspect of the preferred embodiment of the system of the present invention, the inner conductive component of the electrical winding element **(1)** is made of copper; however the inner conductive component can be made of any appropriate material for a stator bar.

0026. In another aspect of the preferred embodiment of the system of the present invention, the short circuit conductive element **(2)** is made of copper. In a preferred form the short circuit conductive element **(2)** is a longitudinal bar. Although the preferred material for the short circuit conductive element **(2)** is copper, the material could be any conductive material

with similar electrical conductive properties as the inner conductive component of the electrical winding element.

0027. In an additional aspect of the preferred embodiment of the system of the present invention, the two connections **(3)** that attach into the closed short circuit the electrical winding element **(1)** and the short circuit conductive element **(2)** are made of copper. Preferably, the connections are copper belts **(3)** with ends that are reinforced with steel to obtain higher mechanical resistance, wherein the copper belt ends are preferably electroplated to avoid corrosion. The connections can also be made with any other material with similar conductive electrical properties as the inner conductive component of the electrical winding.

0028. In a preferred embodiment of the present invention the shielding component of the reactive power compensation part **(5)** is a pair of plate bars, wherein one of the plate bars is positioned along on top contacting a longitudinal section of the electrical winding element **(1)** and the other plate bar is positioned along below contacting the same longitudinal section of the electrical winding element **(1)**. The thickness and material of the plate bars can be changed in order to achieve specific thermal characteristics.

0029. In another aspect of the preferred embodiment of the system of the present invention, the shielding component of the reactive power compensation part **(5)** is made of silicon steel iron, wherein the silicon steel iron has high resistance to current.

0030. The purpose of the shielding component is to adhere to the wrapping component, to concentrate the magnetic field, and to concentrate and dissipate heat, and also the fixing and mechanical protection of the insulating component of the electrical winding element.

0031. In a further aspect of the preferred embodiment of the system of the present invention, the wrapping component of the reactive power compensation part **(5)** is made of aluminum.

0032. The purposes of the wrapping component are to produce a closed and homogenous that is equipotential (equal and homogenous power in all part of the closed short circuit), and to neutralize the possible shielding component (plate bars) partial discharges because the increased electrical field.

0033. The purpose of the capacitor device of the system of the present invention is to further neutralize the reactive power caused because of the charging of the closed short circuit by the step-up transformer using a controlled variable voltage source.

0034. The capacitor device is constituted by a bank of one or more capacitors.

0035. Additional objectives and advantages of the present invention will be more evident in the detailed description of the invention and the claims.

EXAMPLE

0036. A prototype of the system of the present invention was built, wherein the prototype had a close short circuit that was made by joining the ends of a stator bar and a copper bar, wherein the copper bar had the same length and shape of the stator bar, wherein a current was inducted into the short circuit by means of seven transformers that were connected in parallel with additive polarity, wherein each one of the transformers connected in parallel had one turn, wherein the seven transformers connected in parallel constituted the step-up transformer, wherein the closed short circuit was the primary circuit and the transformers connected in parallel constituted the secondary circuit.

0037. The prototype used a primary and secondary circuit with a relation of 2500:5, and with a level of insulation of a least 16kV. The secondary circuit (step-up transformer were fed using a variable electric tension source with technical specifications as illustrated in the following Table 1.:

TABLE 1. Technical Specifications

**VARIABLE ELECTRIC TENSION SOURCE AC WITH
POWER FACTOR CORRECTOR BANK**

Tension Input	Vac	220
Frequency Input	Hz	50-60
Tension Output	Vac	0-280
Frequency Output	Hz	50-60
Maximum Current Output	A	50

**Main Interrupter: Merlin Gerin
Easy-pact EZC100B**

Nominal Current	A	50
Breaking Capacity at 220V	kA	10

Capacitors Bank

100 pF@330 Vac	Units	3
50 pF@330 Vac	Units	2
30 pF@330 Vac	Units	1

Autotransformer

Nominal Power	KVA	7.5
Nominal Current	A	26.7

0038. Because the capacitor device component of the reactive power compensation part (in this prototype the capacitor device was constituted by a bank of three capacitors de 100, 50, and 30 pF @330V), the demand of current from the variable voltage source used by the step-up transformer was low (up to 20A), while the primary current circuit was up to 2500A.

0039. The electric tension was provided by a variable source that allowed subjecting the stator bar to a power differential. The electric tension was applied to the inner conductive component of the stator bar and to the external surface using a monophasic variable transformer with a 380V/32KV relation, and 160kVA, free of partial discharges.

0040. The prototype have a wrapping component made of aluminum foil that wrapped around the shielding component and the stator bar, wherein an endurance voltage test specifications were according to the std IEEE 1043 from 2000.

0041. The prototype system allowed electric power distribution like it happens in an electric machine. The shielding component was made of two silicon steel iron plate bars on top and under the stator bar that imitate the iron plates of an electric machine, wherein the two silicon steel iron plate bars concentrate the magnetic field.

0042. When voltages of 5000V or more are applied, there are probable partial discharges into the electrical winding element (stator bar) surrounding air because of a highly increased electric field. To attenuate this phenomenon, effort control treatment were applied to the stator bar grooves. The effort control treatments were also applied to the straight section of the stator bar. The effort control treatment is made of paints, paper or ribbon built with epoxy resin, reinforced with carbon or carbon-silicon (SiC) with non-lineal characteristics, wherein the effort control treatment also serves to attach the insulating component to the grounded shielding component. Similarly, there is a power grading treatment for the stator bar, wherein the power grading treatment is made of paints, or ribbons with carbon-silicon immersed in a epoxy matrix, wherein the power grading treatment is used to prevent discharges of the stator bar at the shielding component, thus controlling the dielectric effort during a test.

0043. The power grading treatment is applied to the straight section of the stator bar where there is the shielding component, and longitudinally beyond 25mm of the shielding component.

0044. During the test of applied electrical tension and inducted temperature with the prototype system, there is, in the stator bar, a direct relation between electric conductance and thermal conductance, and between escalated electric power and thermal power according to the formula:

$$\vec{\nabla} \cdot (\lambda) \vec{\nabla} T = 0$$

Wherein

λ = material thermal conductance

T = temperature (escalated thermal power)

0045. An adequate grading power treatment and an adequate grounded shielding component during a test of a stator bar, guarantees an insulation component surface constant conductance of about 0.5S/m that corresponds to a superficial resistivity of 20,000 ohms² for a thickness of 0.1mm for a paint case.

0046. The prototype system connections were made with braid copper belts, wherein the braid copper belt ends were electroplated and reinforced with steel in order to obtain high mechanical resistance, to provide thermal homogeneity and to avoid chemical corrosion in environments with high ozone concentrations. The braid copper belts were flexible and had a high range for current conduction (0 to 1500A). Thus with parallel connections is possible to induct currents of 3000A. The braid copper belts were attached to the stator bar and to the short circuit conductive element (Copper longitudinal bar) with four screws as it is shown in **Figure 4**. The connection choice was made based on the current conductance properties of

the braid copper belts, their electric losses, their modes and frequencies (60Hz) which are similar to the current conductance, electric losses, modes and frequencies of the other elements of the closed short circuit.

CLAIMS

1. A system for controlled accelerated thermal aging of electrical windings, wherein the system comprises:
 - A. An electrical winding element and a short circuit conductive element, wherein the electrical winding element has an inner conductive component and an insulation component; wherein each one of the two elements, the electrical winding element and the short circuit conductive element, have two ends, where the two ends of the electrical winding element are attached to the two ends of the short circuit conductive element by means of two connections, wherein the two attached elements, the electrical winding element and the short circuit conductive element, form a closed short circuit;
 - B. An step-up transformer, wherein the step-up transformer uses a controlled variable voltage source, wherein the step-up transformer is connected to the closed short circuit, wherein the step-up transformer using a controlled variable voltage source can provide controlled variable charges to the closed short circuit;
 - C. A reactive power compensation part wrapped around a section of the electrical winding element, wherein the reactive power compensation part has a shielding component and an wrapping component, wherein the shielding component is grounded, wherein the wrapping component is a non-magnetic, non-sparking component;

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D. A capacitor device, wherein the capacitor device is connected to the reactive power compensation part;

wherein charging of the closed short circuit with a controlled charge by the step-up transformer using a controlled variable voltage source, induces heat in the inner conductive component of the electrical winding element, wherein cycles of controlled charges by the step-up transformer using a controlled variable voltage source, generate cycles of flowing current through the closed short circuit, wherein the cycles of flowing current through the closed short circuit produce cycles of heat by induction in the electrical winding element, wherein said cycles of heat produce thermal aging in the insulating component.

2. The system of Claim 1, wherein the electrical winding element is a stator bar.
3. The system of Claim 1, wherein the inner conductive component of the electrical winding element is made of copper.
4. The system of Claim 1, wherein the short circuit conductive element is made of copper.
5. The system of Claim 1, wherein the two connections, that attach into the closed short circuit the electrical winding element and the short circuit conductive element, are made of copper.

6. The system of Claim 1, wherein the shielding component of the reactive power compensation part is made of silicon steel iron.

7. The system of Claim 1, wherein the wrapping component of the reactive power compensation part is made of aluminum.

ABSTRACT

The present invention provides system for testing an electrical winding element that is usually a stator bar or a stator winding. The stator bar is attached to a short circuit conductive element to form a closed short circuit of a single turn that acts as a primary circuit. The closed short circuit is connected to a step-up transformer that will act as a secondary circuit and which has at least two turns. The step-up transformer uses a controlled variable voltage source that charges the closed short circuit. Charging the closed short circuit creates a current in the stator bar inner conductive element, causing heat on the stator bar by induction. The system of the present invention is suitable for an accelerated thermal aging test that simulates closely how heat is created by induction on stator bars of electric machines.

Declaration and Power of Attorney for Patent Application

Declaración y poder para solicitud de patente

Spanish Language Declaration

Como inventor abajo nombrado, por este medio declaro que:

Mi residencia, dirección postal y ciudadanía son los que indican a continuación, al lado de mi nombre.

Considero que soy el primer, original y único inventor (si hay un solo nombre indicado a continuación) o el primer, original y único inventor conjunto (en caso de múltiples nombres a continuación) de la materia objeto de la reivindicación y para la cual se solicita una patente sobre el invento titulado

SYSTEM FOR CONTROLLED AGING OF
ELECTRICAL WINDINGS

cuya descripción se anexa a la presente, salvo que se marque la siguiente casilla:

☐ fue presentada el _____
bajo el número de solicitud de Estados Unidos o
número de solicitud internacional PCT
_____ y modificada el día
_____ (de ser procedente).

Por este medio declaro que he revisado y que entiendo el contenido de la descripción que antecede, incluso las reivindicaciones, según estén modificadas de acuerdo con cualquier modificación arriba citada.

Por este medio reconozco mi deber de divulgar información que sea esencial con respecto a la patentabilidad según se define en el Título 37 del Código de Regulaciones Federales § 1.56.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

the specification of which is attached hereto unless the following box is checked:

☐ was filed on _____
as United States Application Number or PCT
International Application Number
_____ and was amended on
_____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

Spanish Language Declaration

Por este medio reclamo prioridad extranjera bajo el Título 35, Código de Estados Unidos, § 119(a)-(d) o § 365(b) de cualquier o cualesquier solicitud(es) de patente o certificado de inventor extranjera(s), o bajo el Título 35, § 365(a) del mismo Código, de cualquier solicitud internacional PCT en que se designa por lo menos un país distinto a los Estados Unidos, dicha(s) solicitud(es) o dicho(s) certificado(s) enumerándose a continuación, y, marcando la(s) siguiente(s) casilla(s), también he identificado cualquier solicitud de patente o de certificado de inventor extranjera que tenga una fecha de presentación anterior a la fecha de la solicitud sobre la cual se reclama prioridad

Prior Foreign Application(s)
Solicitud(es) Extranjera(s) Anterior(es)

_____ (Number) (Número)	_____ (Country) (País)
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_____ (Number) (Número)	_____ (Country) (País)
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Por este medio reclamo el beneficio bajo el Título 35, Código de Estados Unidos, § 119(e) de cualquier o cualesquier solicitud(es) provisional(es) de Estados Unidos enumerada(s) a continuación.

_____ (Application No.) (Nº de solicitud)	_____ (Filing Date) (Fecha de presentación)
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_____ (Application No.) (Nº de solicitud)	_____ (Filing Date) (Fecha de presentación)
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Por este medio reclamo el beneficio bajo el Título 35, Código de Estados Unidos, § 120 de cualquier o cualesquier solicitud(es) de Estados Unidos o, bajo el Título 35, § 365(c) del mismo Código, de cualquier solicitud internacional PCT en que se designan los Estados Unidos, dicha(s) solicitud(es) enumerándose a continuación y, en la medida en que el objeto de cada una de las reivindicaciones de la presente solicitud no hubiera sido divulgado en la solicitud anterior de Estados Unidos o internacional PCT, según lo dispuesto en el primer párrafo del Título 35, Código de Estados Unidos, § 112, reconozco el deber de divulgar información que fuere esencial con respecto a la patentabilidad, según se define en el Título 37, Código de Regulaciones Federales, § 1.56, que hubiera llegado a estar disponible entre la fecha de presentación de la solicitud anterior y la fecha de presentación nacional o internacional PCT de la presente solicitud.

_____ (Application No.) (Nº de solicitud)	_____ (Filing Date) (Fecha de presentación)
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_____ (Application No.) (Nº de solicitud)	_____ (Filing Date) (Fecha de presentación)
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Por este medio manifiesto que todas las declaraciones hechas en la presente en base a mis propios conocimientos son verdaderas y que considero que son verdaderas todas las declaraciones hechas en base al mayor saber y entender; adicionalmente manifiesto que dichas declaraciones se hicieron con conocimiento de que las declaraciones falsas intencionales y similares son punibles por multa o encarcelamiento o ambos, bajo la Sección 1001 del Título 18 del Código de Estados Unidos y que dichas declaraciones falsas intencionales pueden poner en peligro la validez de la solicitud o de cualquier patente concedida en virtud de la misma.

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

Priority Not Claimed
Derecho de prioridad no reivindicado

(Day/Month/Year Filed)
(Día/Mes/Año de presentación)

(Day/Month/Year Filed)
(Día/Mes/Año de presentación)

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

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

(Status) (patented, pending, abandoned)
(Estado) (patentado, en trámite, abandonado)

(Status) (patented, pending, abandoned)
(Estado) (patentado, en trámite, abandonado)

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

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Spanish Language Declaration

Poder: Como inventor nombrado, por este medio designo al siguiente abogado o abogados y/o agente o agentes para que tramiten la presente solicitud y realicen todas las gestiones ante la Oficina de Patentes y Marcas Registradas en relación con la misma: *(Indique el nombre y número de registro).*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: *(list name and registration number).*

JOHN J. MARTINEZ

Envíe la correspondencia a:

Send Correspondence to:

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Dirija las llamadas telefónicas a:

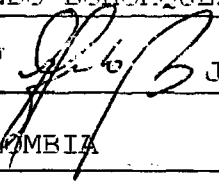
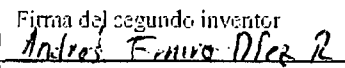
Direct Telephone Calls to:

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(name and telephone number)

JOHN J. MARTINEZ - Reg. No. 48354

(914) 271-7501

Nombre completo del único o primer inventor JOSE AFAMANDO BOHOFQUEZ COETASAR		Full name of sole or first inventor	
Firma del inventor 	Fecha July 27, 2010	Inventor's signature	Date
Residencia COLOMBIA		Residence	
Ciudadanía COLOMBIA		Citizenship	
Dirección postal Carrera 43A # 45B-Sur-91 Casa 116 Envigado, Antioquia, Colombia		Post Office Address	
Nombre completo del segundo inventor conjunto, si lo hubiere ANDRES EMILIO DIEZ RESTREPO		Full name of second joint inventor, if any	
Firma del segundo inventor 	Fecha July 27, 2010	Second Inventor's signature	Date
Residencia COLOMBIA		Residence	
Ciudadanía COLOMBIA		Citizenship	
Dirección postal Carrera 45A # 34Sur-57 Envigado, Antioquia, Colombia		Post Office Address	

(Suministre información similar y firmas del tercer inventor conjunto y subsiguientes.)

(Supply similar information and signature for third and subsequent joint inventors.)

En la página siguiente hay información de

In the next page there is information for

Inventores Adicionales

additional Inventors

Nombre completo del tercer inventor conjunto, si lo hubiere JUAN CARLOS TORO LONDOÑO	Full name of third inventor
Firma del tercer inventor Fecha <i>[Signature]</i> July 27, 2010	Third Inventor's signature Date
Residencia COLOMBIA	Residence
Ciudadanía COLOMBIA	Citizenship
Dirección Postal Carrera 34B # 15A-24 Belen Aliadas Medellin, Antioquia, Colombia	Post Office Address
Nombre completo del cuarto inventor conjunto, si lo hubiere JAIRO LEON RESTREPO VELASQUEZ	Full name of fourth inventor
Firma del cuarto inventor Fecha <i>Jairo Restrepo V.</i> July 27, 2010	Fourth Inventor's signature Date
Residencia COLOMBIA	Residence
Ciudadanía COLOMBIA	Citizenship
Dirección Postal Carrera 52D # 75AA-sur-163 Casa 131 Itagui, Antioquia, Colombia	Post Office Address
Nombre completo del quinto inventor conjunto, si lo hubiere HECTOR DIEGO GONZALEZ SANCHEZ	Full name of fifth inventor
Firma del quinto inventor Fecha <i>[Signature]</i> July 27, 2010	Fifth Inventor's signature Date
Residencia COLOMBIA	Residence
Ciudadanía COLOMBIA	Citizenship
Dirección Postal Circular 3a. # 70-75 Apt. 501 Medellin, Antioquia, Colombia	Post Office Address
Nombre completo del sexto inventor conjunto, si lo hubiere HUGO ALBERTO CARDONA RESTREPO	Full name of sixth inventor
Firma del sexto inventor Fecha <i>[Signature]</i> July 27, 2010	Sixth Inventor's signature Date
Residencia COLOMBIA	Residence
Ciudadanía COLOMBIA	Citizenship
Dirección Postal Carrera 63 # 32E-95 Apt. 501 Medellin, Antioquia, Colombia	Post Office Address

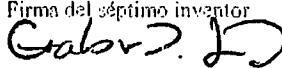
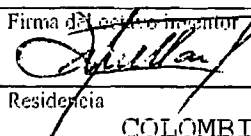
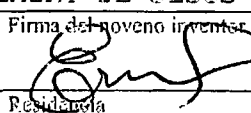
Nombre completo del séptimo inventor conjunto, si lo hubiere GABRIEL JAIME LOPEZ JIMENEZ	Full name of seventh inventor	
Firma del séptimo inventor 	Fecha July 27, 2010	Seventh Inventor's signature Date
Residencia COLOMBIA	Residence	
Ciudadanía COLOMBIA	Citizenship	
Dirección Postal Carrera 79 # 35-43 Apt. 302 Medellin, Antioquia, Colombia	Post Office Address	
Nombre completo del octavo inventor conjunto, si lo hubiere IDI AMIN ISAAC MILLAN	Full name of eighth inventor	
Firma del octavo inventor 	Fecha July 27, 2010	Eighth Inventor's signature Date
Residencia COLOMBIA	Residence	
Ciudadanía COLOMBIA	Citizenship	
Dirección Postal Calle 4Sur # 48-110 Apt. 439 Medellin, Antioquia, Colombia	Post Office Address	
Nombre completo del noveno inventor conjunto, si lo hubiere EMIRO DE JESUS DIEZ SALDARRIAGA	Full name of ninth inventor	
Firma del noveno inventor 	Fecha July 27, 2010	Ninth Inventor's signature Date
Residencia COLOMBIA	Residence	
Ciudadanía COLOMBIA	Citizenship	
Dirección Postal Carrera 45A # 34Sur-57 Envigado, Antioquia, Colombia	Post Office Address	
Nombre completo del décimo inventor conjunto, si lo hubiere	Full name of tenth inventor	
Firma del décimo inventor	Fecha	Tenth Inventor's signature Date
Residencia	Residence	
Ciudadanía	Citizenship	
Dirección Postal	Post Office Address	

FIGURE 1

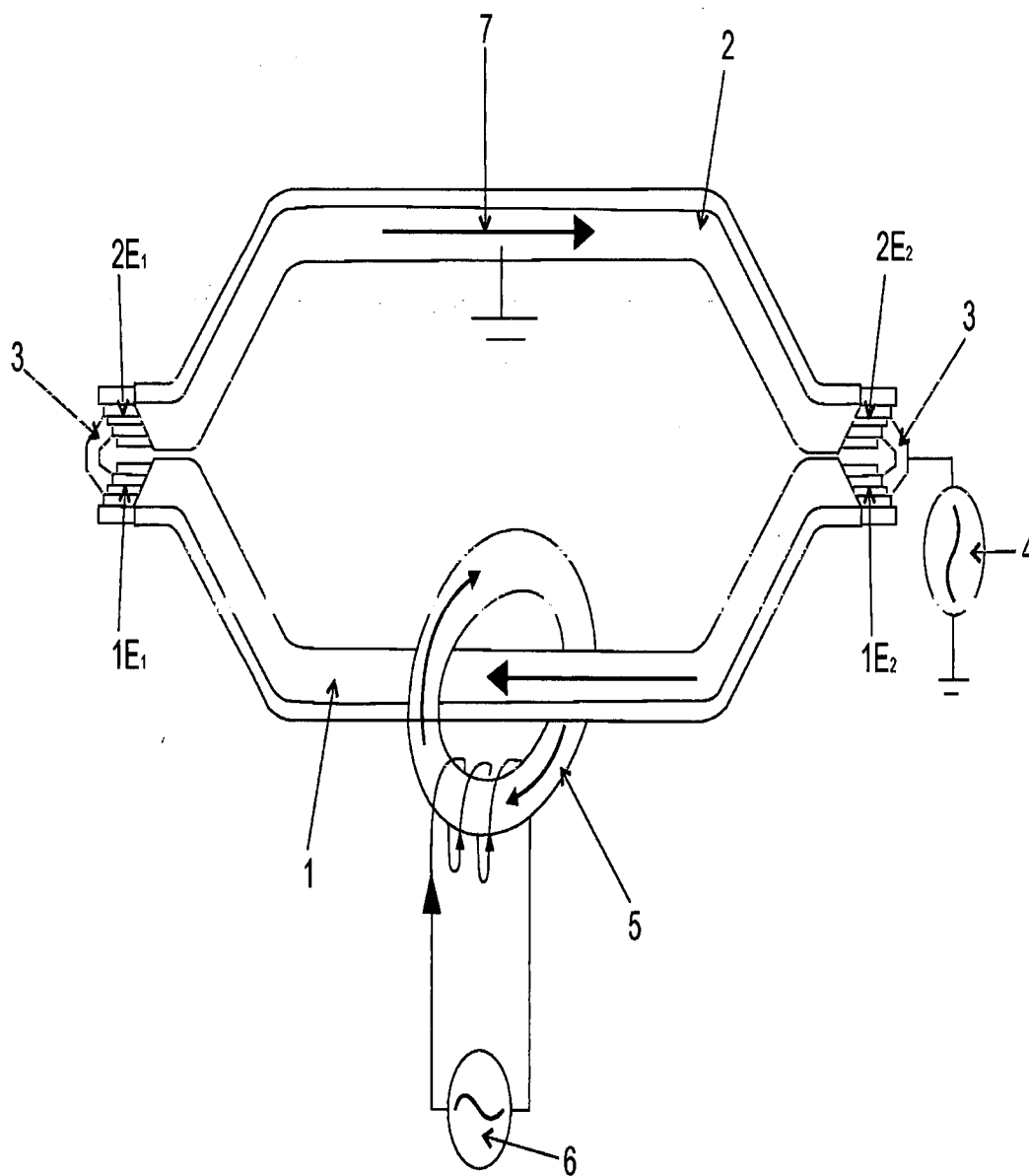
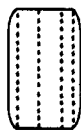
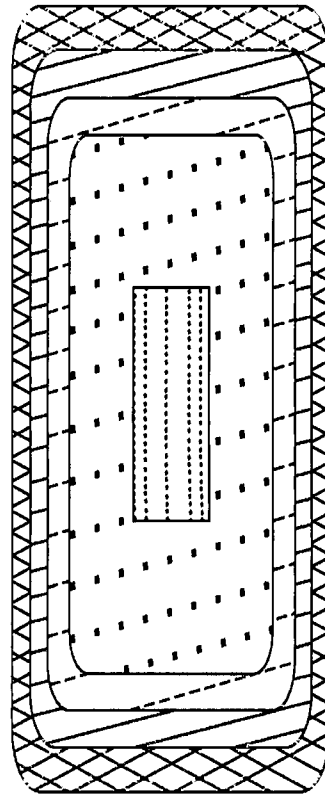
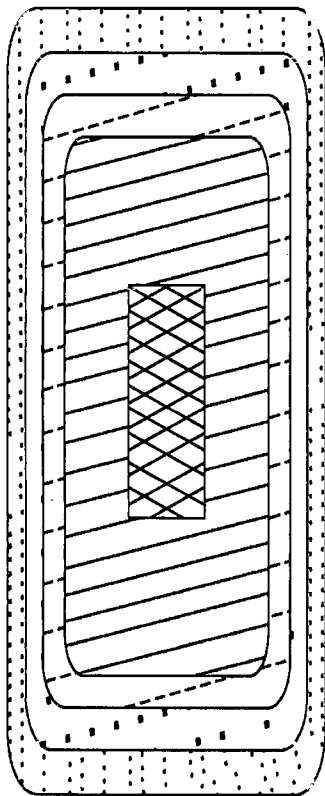


FIGURE 2

Fig. 2A

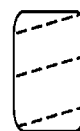
Fig. 2B



$+T^0$



$++T^0$



$+++T^0$



$++++T^0$



$+++++T^0$

FIGURE 3

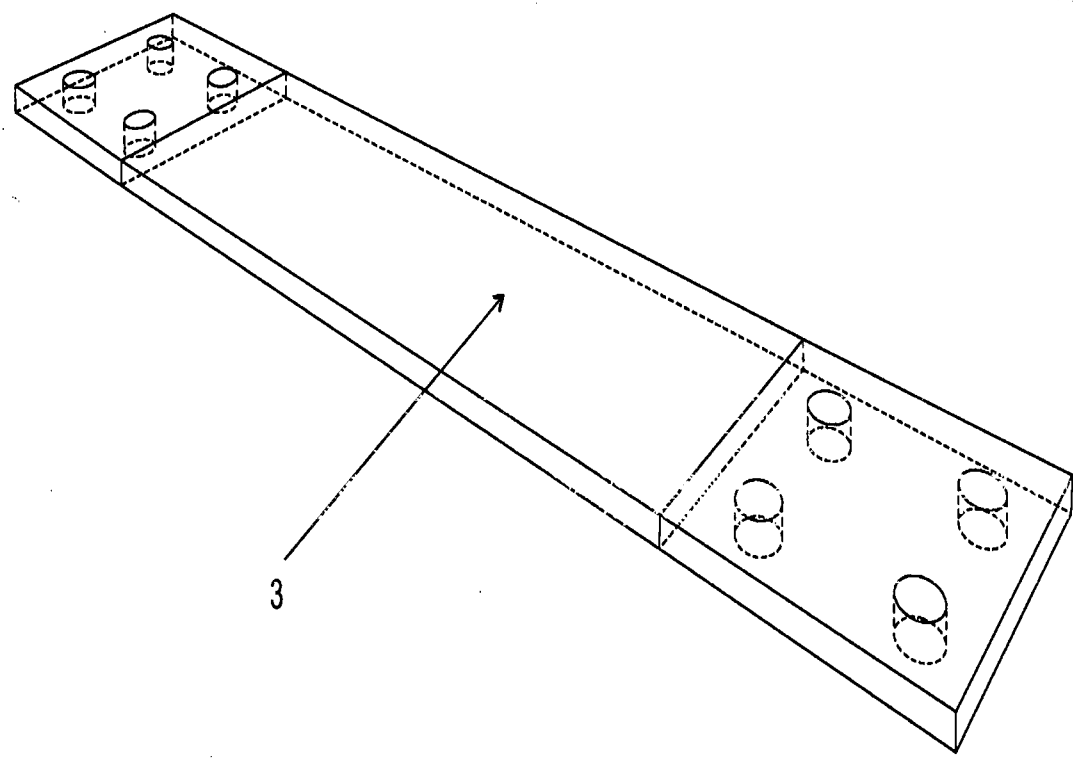


FIGURE 4

