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SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
LACEY GOROCHOW	06/21/2019
ARIEL SOTO DEL VALLE	06/21/2019
JUAN LORENZO	06/21/2019

RECEIVING PARTY DATA

Name:	DEPUY SYNTHES PRODUCTS, INC.
Street Address:	325 PARAMOUNT DRIVE
City:	RAYNHAM
State/Country:	MASSACHUSETTS
Postal Code:	02767

PROPERTY NUMBERS Total: 1

Property Type	Number

Application Number:	15993903

CORRESPONDENCE DATA

Fax Number:	(212)704-6288
Phone:	(212) 704-6000
Email:	IPServicesNYC@troutman.com, Michael.Gartland.Agency@troutman.com

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Correspondent Name:	TROUTMAN SANDERS LLP
Address Line 1:	875 THIRD AVENUE
Address Line 4:	NEW YORK, NEW YORK 10022

ATTORNEY DOCKET NUMBER:	243382.000067
NAME OF SUBMITTER:	MICHAEL A. GARTLAND
Signature:	/Michael A. Gartland/
Date:	07/24/2019

Total Attachments: 3
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RECEIPT INFORMATION

EPAS ID:	PAT5634506
Receipt Date:	07/24/2019

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General Assignment

WHEREAS, **Lacey GOROCHOW**, having its place of business at c/o DePuy Synthes Products, Inc. 325 Paramount Drive Raynham, MA 02767, **Ariel SOTO DEL VALLE**, having its place of business at c/o DePuy Synthes Products, Inc. 325 Paramount Drive Raynham, MA 02767, and **Juan LORENZO**, having its place of business at c/o DePuy Synthes Products, Inc. 325 Paramount Drive Raynham, MA 02767 (hereinafter referred to as “Assignor”), are the owners of certain new and useful inventions relating to

ANEURYSM DEVICE AND DELIVERY SYSTEM

for which on **May 31, 2018**, US Patent Application no. **15/993,903** was filed at the U.S. Patent and Trademark Office**.**

WHEREAS, **DePuy Synthes Products, Inc.**, having its place of business at **325 Paramount Drive Raynham, MA 02767** (hereinafter referred to as “Assignee”) is desirous of acquiring Assignors’ entire right, title and interest therein, including the right to claim priority thereof,

NOW, THEREFORE, BE IT KNOWN, that in view of good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Assignor hereby assigns and transfers, for all countries in the world, to said Assignee its entire right, title and interest, including the right to claim priority, in and to all said inventions disclosed in said applications and in and to said applications, and all foreign equivalents thereof, including all substitutions, divisions, and continuations thereof, and in and to all Letters Patent, that may be granted for said inventions, and in and to all extensions, renewals, and reissues thereof, the same to be held and enjoyed by said Assignee, its successors and assigns, as fully and entirely as the same would have been held and enjoyed by Assignor if this Assignment had not been made.

And for purpose of obtaining patent protection in any foreign country, the Assignor hereby agrees that, any right, title and interest, in and to all said inventions disclosed in said applications and in and to said applications, and all foreign equivalents thereof can be directly assigned by the inventors to the Assignee without explicit confirmation of the Assignor.

The Assignor agrees that this general assignment is effective from the **execution date**.

.

IN TESTIMONY WHEREOF, the Assignor set hereunto its hand and seal this date.

FOR **Lacey GOROCHOW**

Signature

Lacey Gorochow

Name

R+D Engineer

Title of Authorized Signatory

6-21-2019

Date

IN TESTIMONY WHEREOF, the Assignor set hereunto its hand and seal this date.

FOR **Ariel SOTO DEL VALLE**

Signature

Name

Title of Authorized Signatory

Date

IN TESTIMONY WHEREOF, the Assignor set hereunto its hand and seal this date.

FOR **Juan LORENZO**

Signature

Juan Lorenzo

Name

Director R&D

Title of Authorized Signatory

6/21/2019

Date

IN TESTIMONY WHEREOF, the Assignor set hereunto its hand and seal this date.

FOR **Lacey GOROCHOW**

_____
Signature

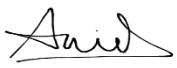
_____
Name

_____
Title of Authorized Signatory

_____
Date

IN TESTIMONY WHEREOF, the Assignor set hereunto its hand and seal this date.

FOR **Ariel SOTO DEL VALLE**



_____
Signature

Ariel Soto Del Valle
Name

Principal Technician
Title of Authorized Signatory

June 21st, 2019
Date

IN TESTIMONY WHEREOF, the Assignor set hereunto its hand and seal this date.

FOR **Juan LORENZO**

_____
Signature

_____
Name

_____
Title of Authorized Signatory

_____

PA 2044707

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

3 de junio de 2019

POR ESTE MEDIO, SE CERTIFICA QUE EL DOCUMENTO ADJUNTO ES UNA COPIA FIEL DE LOS REGISTROS DE LA OFICINA DE PATENTES Y MARCAS DE LOS ESTADOS UNIDOS DE DICHOS DOCUMENTOS DE LA SOLICITUD DE PATENTE IDENTIFICADA A CONTINUACIÓN QUE CUMPLIÓ CON LOS REQUISITOS PARA QUE SE LE OTORGARA UNA FECHA DE PRESENTACIÓN EN VIRTUD DE LO DISPUESTO EN 35 USC 111.

NÚMERO DE SOLICITUD: ***15/993.903***
FECHA DE PRESENTACIÓN: ***31 de mayo de 2018***

EL CÓDIGO DE PAÍS Y EL NÚMERO DE SU SOLICITUD DE PRIORIDAD, QUE SE USARÁ PARA LA PRESENTACIÓN EN EL EXTRANJERO EN VIRTUD DE LA CONVENCIÓN DE PARÍS, ES ***US15/993.903***

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

P. SWAIN
Funcionario certificador

REIVINDICACIONES

Reivindicaciones:

1. Un trenzado para tratar un aneurisma, el trenzado comprende un extremo proximal y un extremo distal, el trenzado comprende:

un segmento distal ubicado alrededor del extremo distal, el segmento distal operable para realizar una transición desde un estado colapsado dentro de un microcatéter a un estado desplegado distal del microcatéter mediante el cual el segmento distal se expande radialmente para formar un saco distal;

un segmento central en comunicación con el segmento distal, en donde el segmento central es capaz de invertirse en el saco distal; y

un segmento proximal en comunicación con el segmento central y ubicado alrededor del extremo proximal, en donde el segmento proximal es capaz de insertarse en el segmento central en el estado desplegado;

en donde cada uno de los segmentos proximal, distal y central comprenden una porosidad diferente o una flexibilidad diferente.

2. El trenzado de la reivindicación 1, que comprende, además, un punto de inflexión ubicado entre el segmento central y el segmento distal, en donde el extremo proximal se configura para insertarse dentro del saco distal en el estado desplegado hasta que el segmento central se invierte de manera que el punto de

inflexión se ubica adyacente al cuello del aneurisma para inducir un efecto de desviación de flujo.

3. Un trenzado para tratar un aneurisma, el trenzado comprende un extremo proximal y un extremo distal, el trenzado comprende:

un segmento distal ubicado alrededor del extremo distal, el segmento distal operable para realizar una transición desde un estado colapsado dentro de un microcatéter a un estado desplegado distal del microcatéter mediante el cual el segmento distal se expande radialmente para formar un saco distal; y

un segmento proximal ubicado alrededor del extremo proximal, en donde el segmento proximal es capaz de invertirse e insertarse en el saco distal.

4. El trenzado de la reivindicación 3, en donde el segmento proximal comprende una porosidad mayor que una porosidad del segmento distal.

5. El trenzado de la reivindicación 4, en donde el extremo proximal se configura para insertarse dentro del saco distal en el estado desplegado hasta que un extremo proximal del segmento distal se ubica adyacente al cuello del aneurisma para inducir un efecto de desviación de flujo.

6. El trenzado de la reivindicación 3, que comprende, además: un punto de inflexión ubicado entre los segmentos proximal y distal.

7. El trenzado de la reivindicación 6, en donde el segmento proximal se configura para invertirse cuando el punto de inflexión está distal del microcatéter o se configura para invertirse por el punto de inflexión cuando el trenzado se ha trasladado distalmente una distancia predeterminada.

8. El trenzado de la reivindicación 3, en donde el saco distal tiene un diámetro al menos dos veces mayor que el microcatéter.

9. El trenzado de la reivindicación 3, que comprende, además, un segmento central ubicado entre los segmentos proximal y distal.

10. El trenzado de la reivindicación 9, en donde cada uno de los segmentos proximal, distal y central comprende una porosidad diferente.

11. El trenzado de la reivindicación 10, en donde el segmento central comprende una porosidad mayor que una porosidad de los segmentos proximal y distal; y

en donde la porosidad del segmento distal es mayor que la porosidad del segmento proximal.

12. El trenzado de la reivindicación 10, comprende, además:

un primer punto de inflexión ubicado entre el segmento distal y el segmento central; y

un segundo punto de inflexión ubicado entre el segmento central y el segmento proximal.

13. El trenzado de la reivindicación 12, en donde en el estado desplegado, el primer punto de inflexión se configura para hacer que el extremo proximal del segmento distal se pandee cuando el trenzado se traslada distalmente una primera distancia; y

en donde en el estado desplegado, el segundo punto de inflexión se configura para hacer que el segmento central se invierta en el segmento distal cuando el trenzado se traslada distalmente una segunda distancia.

14. El trenzado de la reivindicación 12, en donde en el estado desplegado, el primer punto de inflexión se configura para hacer que el extremo proximal del segmento distal se pandee alrededor del cuello del aneurisma; y

en donde en el estado desplegado, en donde el segundo punto de inflexión se configura para hacer que el segmento central se invierta en el segmento distal.

15. El trenzado de la reivindicación 12, en donde cuando el primer punto de inflexión es distal del microcatéter, el primer punto de inflexión se configura para hacer que el extremo proximal del segmento distal se pandee alrededor del cuello del aneurisma;

cuando el segundo punto de inflexión es distal del microcatéter, el segundo punto de inflexión se configura para hacer que el segmento central se invierta en el segmento distal y el segmento proximal se inserte en el segmento central.

16. El trenzado de la reivindicación 12, en donde el segmento proximal y/o central es/son configurado(s) para insertarse dentro del saco distal en el estado desplegado hasta que el primer punto de inflexión se ubique adyacente al cuello del aneurisma para inducir un efecto de desviación de flujo.

17. Un método para ocluir un aneurisma, que comprende:

posicionar selectivamente un trenzado en o adyacente a un cuello del aneurisma;

deslizar distalmente el trenzado en el aneurisma;

expandir radialmente un segmento distal del trenzado para formar un saco distal dentro del aneurisma, el saco distal configurado para ocluir el aneurisma;

deslizar distalmente aún más el trenzado en el aneurisma pandeando de esta manera el pandeo del segmento distal alrededor del cuello del aneurisma;

deslizar distalmente aún más el trenzado en el aneurisma invirtiendo de esta manera un segmento central del trenzado en el segmento distal;

insertar un segmento proximal del trenzado en el segmento central; y

liberar el trenzado dentro del aneurisma.

18. El método de la reivindicación 17, que comprende, además:

insertar el segmento proximal en el segmento central hasta que un punto de inflexión entre el segmento distal y el segmento central sea adyacente o esté en comunicación con el cuello del aneurisma; e

inducir un efecto de desviación del flujo a través del cuello del aneurisma.

19. El método de la reivindicación 17, que comprende, además:

posicionar un primer punto de inflexión entre el segmento distal y el segmento central;

posicionar un segundo punto de inflexión entre el segmento central y el segmento proximal;

pandear el segmento distal alrededor del cuello del aneurisma, por el primer punto de inflexión, cuando se traslada distalmente un extremo proximal del trenzado una primera distancia con respecto al cuello del aneurisma; e

invertir el segmento central en el segmento distal, por el segundo punto de inflexión, trasladando distalmente el extremo proximal del trenzado una segunda distancia con respecto al cuello del aneurisma.

20. El método de la reivindicación 19, en donde invertir el segmento central en el segmento distal, por el segundo punto de inflexión, hace que el segmento central se inserte en el segmento distal.

Clarke, Modet & Cº
COLOMBIA

P-2019/21304

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIRECCIÓN DE NUEVAS CREACIONES
E. S. D.

Ref.: Expediente No. **NC2019/0005699**
Solicitud de registro de patente de invención a nombre de **DEPUY SYNTHES PRODUCTS, INC.**

Yo, CAROLINA DAZA MONTALVO, identificada como aparece al pie de mi firma, domiciliada en la Carrera 11 No. 86-53, piso 3, obrando como apoderada de la solicitante de la patente de invención de la referencia, **DEPUY SYNTHES PRODUCTS, INC.**, en respuesta al Oficio No. 4196 del 7 de junio de 2019, atentamente me permito presentar los siguientes documentos:

1. **Análisis de prioridad:** Se allega a este despacho copia certificada de la solicitud de la cual se invoca prioridad.

2. **Cesión**: Asimismo, se adjunta el documento de cesión de los inventores.

Habiendo dado cumplimiento al requerimiento de este Despacho, solicito respetuosamente se continúe con el trámite de la referencia.

Atentamente,

CAROLINA DAZA MONTALVO
C.C. 66.783.790 de Palmira Valle
TP-141563 CSJ
notificaciones@clarkemodet.com.co

TRADUCCIÓN OFICIAL No. 134/CKM REALIZADA POR DIEGO F. VARGAS ZAMORA, TRADUCTOR E INTÉRPRETE OFICIAL INGLÉS-ESPAÑOL, RECONOCIDO MEDIANTE RESOLUCIÓN No. 0001 DEL 4 DE ENERO DE 1999 DEL MINISTERIO DE JUSTICA

Sistema Electrónico de Cesión de Patentes

Recibo de Confirmación

Su cesión ha sido recibida por la Oficina de Patentes de los Estados Unidos

A continuación se presenta la portada de la cesión:

PORTADA DE CESIÓN DE PATENTE

Versión Electrónica v1.1

Versión Hoja de estilo v1.2

TIPO DE PRESENTACIÓN:	NUEVA CESIÓN
NATURALEZA DE ENAJENACIÓN:	CESIÓN

INFORMACIÓN PARTE CEDENTE

Nombre	**Fecha de Suscripción**
LACEY GOROCHOW	06/21/2019
ARIEL SOTO DEL VALLE	06/21/2019
JUAN LORENZO	06/21/2019

INFORMACIÓN PARTE RECEPTORA

Nombre:	DEPUY SYNTHES PRODUCTS, INC.
Dirección:	325 PARAMOUNT DRIVE
Ciudad:	RAYNHAM
Estado/País	MASSACHUSETTS
Código Postal	02767

NÚMERO DE BIENES Total: 1

Tipo de bien	Número

Solicitud Número:	15993903

INFORMACIÓN DE CORRESPONDENCIA:

Número Fax: (212) 704-6288
Teléfono: (212) 704-6000
Correo electrónico: IPServicesNYC@troutman.com, Michael.Gartland.Agency@troutman.com

Se enviará la correspondencia primero a la dirección de correo electrónico; si es infructuoso, se enviará empleando un número de fax, si fue suministrado, si esto es infructuoso, se enviará por Correo de los Estados Unidos.

Nombre del Corresponsal: TROUTMAN SANDERS LLP
Dirección Línea 1: 875 THIRD AVENUE
Dirección Línea 4: NUEVA YORK, NUEVA YORK 10022

REFERENCIA DEL APODERADO:	243382.000067
NOMBRE DEL REMITENTE:	MICHAEL A. GARTLAND
Firma	/Michael A. Gartland/
Fecha:	07/24/2019

Total Adjuntos: 3

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INFORMACIÓN DE RECIBO

EPAS ID: PAT5634506

Fecha Recibo: 07/24/2019

Regresar a página de inicio

Cesión General

CONSIDERANDO que **Lacey GOROCHOW**, domiciliado en c/o DePuy Synthes Products, Inc. 325 Paramount Drive, Raynham, MA 02767, **Ariel SOTO DEL VALLE**, domiciliado en c/o DePuy Synthes Products, Inc. 325 Paramount Drive, Raynham, MA 02767 y **Juan LORENZO**, domiciliado en c/o DePuy Synthes Products, Inc. 325 Paramount Drive, Raynham, MA 02767 (denominados en adelante

como el "Cedente"), son los propietarios de ciertas y útiles invenciones relativas a

DISPOSITIVO DE ANEURISMA Y SISTEMA DE ENTREGA

para la cual se presentó ante la Oficina de Marcas y Patentes de los Estados Unidos el **31 de mayo de 2018** la solicitud de patente no. **15/993,903** de los Estados Unidos.

CONSIDERANDO que **DePuy Synthes Products, Inc.**, domiciliada en **325 Paramount Drive, Raynham, MA 02767** (en adelante la "Cesionaria") desea adquirir todo el derecho, título e interés del cedente en esta, incluyendo el derecho de reivindicar prioridad respecto a la misma.

POR CONSIGUIENTE, POR EL PRESENTE SE DEJA CONSTANCIA que en razón de contraprestación válida y legal, el recibo y suficiencia de la cual se reconoce por el presente, el Cedente por el presente cede y transfiere, para todos los países del mundo, a dicha Cesionaria, todo su derecho, título e interés, incluyendo el derecho de reivindicar prioridad en y a todas dichas invenciones divulgadas en dichas solicitudes, así como en y a dichas solicitudes y todas las equivalencias extranjeras de las mismas, incluyendo todas las sustituciones, divisiones y continuaciones de las mismas, así como en y todas las Patentes de Invención, que se lleguen a otorgar a dichas invenciones, y a todas las prórrogas, renovaciones y reexpediciones de las mismas, para que estas sean tenidas y disfrutadas por dicha Cesionaria, sus sucesores y cesionarios, tan completa y plenamente como estas hubieran sido tenidas y disfrutadas por el Cedente, si no se hubiera realizado la presente Cesión.

Y con el objeto de obtener protección de patentes en cualquier país extranjero, el Cedente por el presente acuerda que cualquier derecho, título e interés en y todas dichas invenciones divulgadas en dichas solicitudes, así como en y a dichas solicitudes y todas las equivalencias extranjeras de las mismas, pueden ser cedidas directamente por los inventores a la Cesionaria, sin que medie confirmación explícita del Cedente.

El Cedente acuerda que la presente cesión general está vigente a partir de la **fecha de suscripción.**

EN TESTIMONIO DE LO CUAL, el Cedente ha fijado su firma y sello el día de hoy.

POR **Lacey GOROCHOW**

Firma Ilegible
Firma

Lacey Gorochow
Nombre

Ingeniero de Investigación y Desarrollo
Cargo del Signatario Autorizado

6-21-2019
Fecha

POR **Ariel SOTO DEL VALLE**

Firma Ilegible
Firma

Arial Soto del Valle
Nombre

Técnico Principal
Cargo del Signatario Autorizado

21 de junio de 2019
Fecha

DIEGO F. VARGAS Z.
TRADUCTOR E INTERPRETE OFICIAL
ESPAÑOL - INGLES - INGLES - ESPAÑOL
RES. 0001 DE ENERO 4 DE 199
MINISTERIO DE JUSTICIA

POR **Juan Lorenzo**

Firma Ilegible

Firma

Juan Lorenzo

Nombre

Director de Investigación y Desarrollo

Cargo del Signatario Autorizado

6/21/2019

Fecha

FIN DE LA TRADUCCIÓN

Bogotá D.C., 5 de agosto de 2019
Es traducción fiel y completa del documento original realizada por:
DIEGO F. VARGAS ZAMORA, Traductor e Intérprete Oficial Según Resolución No. 0001 de 1999
Ministerio de Justicia de Colombia.

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

PA 2044707

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

June 03, 2019

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: *15/993,903*
FILING DATE: *May 31, 2018*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US15/993,903*

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:	32767989
Application Number:	15993903
International Application Number:	
Confirmation Number:	8457
Title of Invention:	ANEURYSM DEVICE AND DELIVERY SYSTEM
First Named Inventor/Applicant Name:	Lacey GOROCHOW
Customer Number:	6980
Filer:	Louis J. DelJuidice/Cheryll Cabrera
Filer Authorized By:	Louis J. DelJuidice
Attorney Docket Number:	243382.000067
Receipt Date:	31-MAY-2018
Filing Date:	
Time Stamp:	12:43:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1720
RAM confirmation Number	053118INTEFSW00012311201507
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Specification	DEPUY67-SPECIFICATION-FINAL-2018-05-31.PDF	193055 b67ec463332f9052fc7dcf9a5045e0314a6df2ac	no	25
Warnings:					
Information:					
2	Drawings-only black and white line drawings	DEPUY67-DRAWINGS-FINAL-2018-05-31.PDF	1839575 c7a15989ae317b3661903aca922f8be167d0e731	no	9
Warnings:					
Information:					
3	Transmittal of New Application	DEPUY67-TRANSMITTAL-FINAL-2018-05-31.PDF	298866 673ffac7dc4ccb316ca27174e8738cf783f3ae62	no	2
Warnings:					
Information:					
4	Application Data Sheet	DEPUY67-ADS-FINAL-2018-05-31.PDF	1845528 413e029dc6e696a955355a69545e0dbbf4324734	no	9
Warnings:					
Information:					
5	Oath or Declaration filed	DEPUY67-DEC-LORENZO-FINAL-2018-05-31.PDF	109221 f9e7f1c23658f6c02f637d2be911e38561058d92	no	1
Warnings:					
Information:					
6	Oath or Declaration filed	DEPUY67-DECS-GOROCHOW-SOTODELVALLE-FINAL-2018-05-31.PDF	1080371 afef47a2bb3138eb78bcab20e4d5521f3658477d	no	2
Warnings:					
Information:					

7	Power of Attorney	DEPUY67-POA-FINAL-2018-05-31.PDF	912601 4d71072317785c9e7e5ffd68ad380a634e97f720	no	2
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	34984 e420c026ae373854a1646cd1f97a8b20044e8c3d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	6314201		

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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.

PTO/AIA/15 (03-13)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	243382.000067
First Named Inventor	Lacey GOROCHOW
Title	ANEURYSM DEVICE AND DELIVERY SYSTEM
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☐ **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. ☐ **Applicant asserts small entity status.** See 37 CFR 1.27
3. ☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. ☑ **Specification** [*Total Pages* 25] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. ☑ **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 9]
6. **Inventor's Oath or Declaration** [*Total Pages* 3] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. ☑ Newly executed (original or copy)
   b. ☐ A copy from a prior application (37 CFR 1.63(d))
7. ☑ **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   ☐ Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. ☐ Computer Readable Form (CRF)
   b. ☐ Specification Sequence Listing on:
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ACCOMPANYING APPLICATION PAPERS

10. ☐ **Assignment Papers** (cover sheet & document(s)) Name of Assignee _____
11. ☐ **37 CFR 3.73(c) Statement** (*when there is an assignee*) ☑ **Power of Attorney**
12. ☐ **English Translation Document** (*if applicable*)
13. ☐ **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    ☐ Copies of citations attached
14. ☐ **Preliminary Amendment**
15. ☐ **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. ☐ **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. ☐ **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. ☐ **Other:** _____

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

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This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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ANEURYSM DEVICE AND DELIVERY SYSTEM

FIELD

[0001] This disclosure relates to medical instruments, and more particularly, delivery systems for aneurysm therapy.

BACKGROUND

[0002] Aneurysms can be complicated and difficult to treat. For example, treatment access may be limited or unavailable when an aneurysm is located proximate critical tissues. Such factors are of particular concern with cranial aneurysms due to the brain tissue surrounding cranial vessels the corresponding limited treatment access.

[0003] Prior solutions have included endovascular treatment access whereby an internal volume of the aneurysm sac is removed or excluded from arterial blood pressure and flow. In this respect, because the interior walls of the aneurysm may continue being subjected to flow of blood and related pressure, aneurysm rupture remains possible.

[0004] Alternative to endovascular or other surgical approaches can include occlusive devices. Such devices have typically incorporated multiple embolic coils that are delivered to the vasculature using microcatheter delivery systems. For example, when treating cranial aneurysms, a delivery catheter with embolic coils is typically first inserted into non-cranial vasculature through a femoral artery in the hip or groin area. Thereafter, the catheter is guided to a location of interest within the cranium. The sac of the aneurysm can then be filled with the embolic material to create a thrombotic mass that protects the arterial walls from blood flow and related pressure. However, such occlusive devices do have certain shortcomings, including mass effect, which can cause compression on the braid and its nerves. Furthermore, embolic coils do not always effectively treat aneurysms as re-canalization of the aneurysm and/or coil compaction can occur over time.

[0005] One particular type of occlusive approach endeavors to deliver and treat the entrance or "neck" of the aneurysm as opposed to the volume of the aneurysm by implanting a device in the parent vessel of the aneurysm. In such "neck" approaches, by minimizing blood flow across the neck, a cessation of flow into the aneurysm may be achieved. In turn, a thrombotic mass may naturally form without having to deliver embolic materials into the aneurysm sac, as previously described. This approach is preferable to masses formed from

embolic material since a natural mass can improve healing by reducing possible distention from arterial walls and permits reintegration into the original parent vessel shape along the neck plane of the aneurysm. It is understood that the neck plane is an imaginary surface where the inner most layer of the parent wall would be but for the aneurysm. However, neck-occlusive approaches, such as implanting a flow impeding device in the parent vessel, are not without drawbacks. This type of approach may impede blood flow into peripheral blood vessels while blocking the aneurysm neck in the parent vessel. Impeding flow to the peripheral blood vessel can unintentionally lead to severe damage if the openings of the vessels are blocked.

[0006] The solution of this disclosure resolves these and other issues of the art.

SUMMARY

[0007] In some embodiments, the present disclosure relates to a braid for treating an aneurysm. The braid can include a proximal end and a distal end. The braid can also include a distal segment disposed about the distal end. The distal segment can be configured to transition from a collapsed state within a microcatheter to a deployed state distal of the microcatheter whereby the distal segment has radially expanded to form a distal sack. A central segment can be disposed in communication with the distal segment. The central segment can be capable of inverting into the distal sack A proximal segment can be disposed in communication with the central segment and disposed about the proximal end. The proximal segment can be capable of being tucked into the central segment in the deployed state. Each of the proximal, distal, and central segments can have a different porosity and/or a different flexibility.

[0008] In some embodiments, the distal, central, and proximal segments are formed from a single monolithic structure.

[0009] In some embodiments, the distal, central, and proximal segments are discrete connected components of a single mesh.

[0010] In some embodiments, an inflection point is disposed between the central segment and the distal segment. The proximal end of the braid can be configured to be tucked inside the distal sack in the deployed state until the central segment is inverted so the inflection point is disposed adjacent the neck of the aneurysm to induce a flow diverting effect.

[0011] In some embodiments, a braid for treating an aneurysm is disclosed. The braid can include a proximal end and a distal end. The braid can also include a distal segment

disposed about the distal end, the distal segment operable to transition from a collapsed state within a microcatheter to a deployed state distal of the microcatheter whereby the distal segment radially expands to form a distal sack. A proximal segment can be disposed about the proximal end, wherein the proximal segment is capable of inverting and being tucked into the distal sack.

[0012] In some embodiments, the proximal segment includes a porosity greater than a porosity of the distal segment, or vice versa. The proximal end can be configured to be tucked inside the distal sack in the deployed state until a proximal end of the distal segment is disposed adjacent the neck of the aneurysm to induce a flow diverting effect. The distal sack can also be spherical, though the braid is not so limited and its distal sack can take any shape as needed or required. The distal segment can include a flexibility greater than a flexibility of the proximal segment, or vice versa.

[0013] In some embodiments, the braid can also include an inflection point disposed between the proximal and distal segments. The proximal segment can also be configured to be inverted when the inflection point is distal of the microcatheter. The proximal segment can be configured to be inverted by the inflection point when the braid has been translated distally a predetermined distance with respect to the microcatheter and/or the aneurysm.

[0014] In some embodiments, the proximal segment is configured to be inverted into the distal segment as the braid is distally pushed deeper into the aneurysm. The proximal segment can be configured to be inverted into the distal segment in a "tube-sock" manner.

[0015] In some embodiments, the distal sack has a diameter at least two times greater than the microcatheter. However, the diameter of the distal sack in the deployed state can be larger or smaller, as needed or required according to the particular aneurysm being occluded.

[0016] In some embodiments, the braid can include a central segment disposed between the proximal and distal segments. Each of the proximal, distal, and central segments can include a different flexibility. The central segment can include a flexibility greater than a flexibility of the proximal and distal segments. The flexibility of the distal segment can be greater than the flexibility of the proximal segment. In some embodiments, in the deployed state, at least some of the central segment can be tapered where the central segment communicates with the distal segment.

[0017] In some embodiments, each of the proximal, distal, and central segments comprise a different porosity. The central segment can include a porosity greater than a porosity

of the proximal and distal segments. The porosity of the distal segment can be greater than the porosity of the proximal segment. The central segment can be configured for positioning on or adjacent the neck of the aneurysm in the deployed state to induce a flow diverting effect.

[0018] In some embodiments, a first inflection point can be disposed between the distal segment and the central segment and a second inflection point can be disposed between the central segment and the proximal segment. In the deployed state, the first inflection point is configured to cause the proximal end of the distal segment to buckle when the braid is distally translated a first distance. In the deployed state, the second inflection point is configured to cause the central segment to invert into the distal segment when the braid is distally translated a second distance. In other embodiments, in the deployed state, the first inflection point is configured to cause the proximal end of the distal segment to buckle about the neck of the aneurysm and the second inflection point is configured to cause the central segment to invert into the distal segment. In other embodiments, when the first inflection point is distal of the microcatheter (e.g. inside the aneurysm), the first inflection point is configured to cause the proximal end of the distal segment to buckle about the neck of the aneurysm and when the second inflection point is distal of the microcatheter, the second inflection point is configured to cause the central segment to invert into to the distal segment and the proximal segment tuck into the central segment.

[0019] In some embodiments, the proximal and/or central segment are/is configured to be tucked inside the distal sack in the deployed state until the first inflection point is disposed adjacent the neck of the aneurysm to induce a flow diverting effect. The proximal segment and the central segment can also be configured to be inverted into the distal segment in a "tube-sock" manner.

[0020] In some embodiments, an occlusive system for treating an aneurysm is disclosed. The system can include a microcatheter and a delivery tube translatably disposed in the microcatheter. A braid can also be included and connected the braid being detachably connected to the delivery tube (e.g. a locking portion disposed at the proximal end of the braid detachably connected to the distal end of the delivery tube) and slideably disposed within the microcatheter in a collapsed state and distally translatable from within the microcatheter to a deployed state distal of the microcatheter in the aneurysm. The braid can expand, including the distal, central and/or proximal expandable segments, to the deployed state as the distal end of the braid distally

exits the microcatheter, contacts the aneurysm wall, and/or is otherwise disposed inside the aneurysm, distal of the microcatheter.

[0021] In some embodiments, translating the braid distally away from the microcatheter causes the central segment to invert into the distal sack and the proximal segment to tuck in the central segment. In some embodiments, the central segment can include a porosity greater than a porosity of the proximal and distal segments. The porosity of the distal segment can be greater than the porosity of the proximal segment. The central segment can be configured for positioning on or adjacent the neck of the aneurysm in the deployed state to induce a flow diverting effect.

[0022] In some embodiments, in the deployed state, the braid is detachable from the microcatheter and/or the delivery tube in the aneurysm.

[0023] In some embodiments, the system can also include radiopaque entities such as platinum wires woven into the braid, or drawn filled tube wires with platinum so that the device can be imaged under fluoroscopy. Including these entities will allow the user to understand and visualize the location of the distal sack with respect to the aneurysm. The orientation and/or a position of the distal sack or any other feature of the braid, is adjustable by the braid being distally or proximally moved by the delivery tube.

[0024] In some embodiments, the system can also include an imaging device operatively connected to the occlusive device. The imaging device is capable of imaging the distal sack with respect to the aneurysm so that an orientation and/or a position of the distal sack, or any other feature of the braid, is adjustable by the braid being distally or proximally moved by the delivery tube.

[0025] In some embodiments, a method of occluding an aneurysm is disclosed. The method can include selectively positioning a braid at or adjacent a neck of the aneurysm; distally sliding the braid into the aneurysm; radially expanding a distal segment of the braid to form a distal sack inside the aneurysm, the distal sack configured to occlude the aneurysm; further distally sliding the braid into the aneurysm thereby buckling the distal segment buckle about the neck of the aneurysm; further distally sliding the braid into the aneurysm thereby inverting a central segment of the braid into the distal segment; tucking a proximal segment of the braid into the central segment; and releasing the braid within the aneurysm.

[0026] In some embodiments, the method can include tucking the proximal segment into the central segment until an inflection point between the distal segment and the central segment is adjacent or in communication with the neck of the aneurysm; and inducing a flow diverting effect across the neck of the aneurysm. In some embodiments, during said tucking, the distal segment does not move relative to the distal segment.

[0027] In some embodiments, the method can include positioning a first inflection point between the distal segment and the central segment; positioning a second inflection point between the central segment and the proximal segment; buckling the distal segment about the neck of the aneurysm, by the first inflection point, when distally translating a proximal end of the braid a first distance with respect to the neck of the aneurysm; and inverting the central segment into the distal segment, by the second inflection point, by distally translating the proximal end of the braid a second distance with respect to the neck of the aneurysm. In some embodiments, inverting the central segment into the distal segment, by the second inflection point, causes the central segment to taper into the distal segment. The tapered portion between the central and distal segments can also be disposed on or adjacent the neck of the aneurysm in the deployed state.

[0028] In some embodiments, the method can include forming the central segment with a porosity greater than a porosity of the proximal and distal segments; and forming the porosity of the distal segment greater than the porosity of the proximal segment.

[0029] In some embodiments, a method of occluding an aneurysm is disclosed. The method can include positioning a braid with the delivery tube, the braid being in a collapsed state with the microcatheter; selectively positioning the microcatheter, the delivery tube, and the braid at or adjacent the neck of the aneurysm; distally sliding the braid, by the delivery tube, from the microcatheter into the aneurysm; radially expanding a distal segment of the braid to form a distal sack inside the aneurysm, the distal sack configured to occlude the aneurysm; further distally sliding the braid, by the delivery tube, thereby buckling the distal segment about the neck of the aneurysm; further distally sliding the braid, by the delivery tube, thereby inverting a central segment of the braid proximal the distal segment into the distal sack; tucking a proximal segment proximal the central segment into the central segment; and releasing the braid within the aneurysm and withdrawing the delivery tube and the microcatheter from the aneurysm.

[0030] In some embodiments, the method can include positioning a first inflection point between the distal segment and the central segment; positioning a second inflection point between the central segment and the proximal segment; buckling the distal segment about the neck of the aneurysm, by the first inflection point, when distally translating a proximal end of the braid a first distance with respect to the neck of the aneurysm; and inverting the central segment into the distal segment, by the second inflection point, by distally translating the proximal end of the braid a second distance with respect to the neck of the aneurysm.

[0031] In some embodiments, inverting the central segment into the distal sack creates a flow diverting effect across the neck of the aneurysm.

[0032] In some embodiments, the method can include forming each of the proximal, distal, and central segments with a different porosity.

[0033] In some embodiments, the method can include forming the central segment with a porosity greater than a porosity of the proximal and distal segments; and forming the porosity of the distal segment greater than the porosity of the proximal segment.

[0034] In some embodiments, the method can include tucking the proximal segment into the central segment until the central segment is adjacent or in communication with the neck of the aneurysm; and inducing a flow diverting effect across the neck of the aneurysm.

[0035] Other aspects and features of the present disclosure will become apparent to those of ordinary skill in the art, upon reviewing the following detailed description in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Reference will now be made to the accompanying drawings, which are not necessarily drawn to scale.

[0037] FIG. 1 depicts an example occlusive device of this disclosure partially deployed into an aneurysm.

[0038] FIG. 2 is a schematic side view of an exemplary delivery system with an occlusive device in communication with, and deployed from, a microcatheter;

[0039] FIG. 3 is an enlarged schematic side view of the braid of FIGs. 1-2 in an expanded state;

[0040] FIG. 4A is an enlarged schematic side view of the delivery system and braid of FIGs. 1-3 as the braid is being continually pushed into an example aneurysm;

[0041] FIG. 4B is an enlarged schematic side view of the delivery system and braid of FIGs. 1-3 as the braid is being pushed into an example aneurysm;

[0042] FIG. 5A is an enlarged schematic side view of the delivery system and braid of FIGs. 1-3 as the braid is being pushed and inverted into an example aneurysm;

[0043] FIG. 5B is an enlarged schematic side view of the delivery system and braid of FIGs. 1-3 after the braid is deployed into an example aneurysm;

[0044] FIG. 6A is a perspective schematic view showing an exemplary delivery system for use with an example occlusive device;

[0045] FIG. 6B is a perspective schematic view of FIG. 6A but with partial cross-section of the delivery system and the occlusive device;

[0046] FIG. 7A is a perspective schematic view of FIGs. 6A-6B being deployed with partial cross-section of the delivery system and the occlusive device;

[0047] FIG. 7B is a perspective schematic view of FIGs. 6A-6B deployed with the exemplary delivery system detached from the occlusive device;

[0048] FIG. 8 is a flow diagram for a method of delivering an occlusive device.

[0049] FIG.9 is a flow diagram for a method of delivering an occlusive device.

DETAILED DESCRIPTION

[0050] Although example embodiments of the disclosed technology are explained in detail herein, it is to be understood that other embodiments are contemplated. Accordingly, it is not intended that the disclosed technology be limited in its scope to the details of construction and arrangement of components set forth in the following description or illustrated in the drawings. The disclosed technology is capable of other embodiments and of being practiced or carried out in various ways.

[0051] It must also be noted that, as used in the specification and the appended claims, the singular forms "a," "an" and "the" include plural referents unless the context clearly dictates otherwise. By "comprising" or "containing" or "including" it is meant that at least the named compound, element, particle, or method step is present in the composition or article or method, but does not exclude the presence of other compounds, materials, particles, method steps, even if

the other such compounds, material, particles, method steps have the same function as what is named.

[0052] In describing example embodiments, terminology will be resorted to for the sake of clarity. It is intended that each term contemplates its broadest meaning as understood by those skilled in the art and includes all technical equivalents that operate in a similar manner to accomplish a similar purpose. It is also to be understood that the mention of one or more steps of a method does not preclude the presence of additional method steps or intervening method steps between those steps expressly identified. Steps of a method may be performed in a different order than those described herein without departing from the scope of the disclosed technology. Similarly, it is also to be understood that the mention of one or more components in a device or system does not preclude the presence of additional components or intervening components between those components expressly identified.

[0053] As discussed herein, vasculature of a "subject" or "patient" may be vasculature of a human or any animal. It should be appreciated that an animal may be a variety of any applicable type, including, but not limited thereto, mammal, veterinarian animal, livestock animal or pet type animal, etc. As an example, the animal may be a laboratory animal specifically selected to have certain characteristics similar to a human (e.g., rat, dog, pig, monkey, or the like). It should be appreciated that the subject may be any applicable human patient, for example.

[0054] As discussed herein, "operator" may include a doctor, surgeon, or any other individual or delivery instrumentation associated with delivery of a braid body to the vasculature of a subject.

[0055] Turning to FIG. 1, an example braid 10 of this disclosure is shown deployed into an aneurysm A of blood vessel BV but not yet released from the microcatheter 20, including delivery tube 30 that is disposed therein, which is shown more clearly in FIG. 2. Braid 10 addresses the drawbacks of coils by being a single device configured to treat the aneurysm A and improves the sealing of the aneurysm neck. In FIG. 1, the microcatheter 20 has been delivered to the neck of the aneurysm A and a distal sack has formed by a distal segment 12 of braid 10. Braid 10 is shown forming a predetermined shape and structure configured to outline, and support the walls of the aneurysm A.

[0056] The size of the microcatheter 20 shown in FIG. 1 is selected in consideration of the size, shape, and directionality of the aneurysm or the body lumens the catheter must pass through to get to the treatment site. The microcatheter 20 may have a total usable length anywhere from 80 centimeters to 170 centimeters. The microcatheter 20 may have an inner diameter ID of anywhere between 0.015 and 0.032 inches. The outer diameter OD may also range in size and may narrow at either its proximal end or distal end. At its proximal end 26, the microcatheter 20 may be manually operated by the end-user, and at its distal end 24 may be operable, as illustrated, to be positioned at the neck of the aneurysm A. While the distal end 24 of the microcatheter 20 can contain the braid 10, the end 24 may be varied in shape and may curve at an angle.

[0057] Turning to FIG. 2, a schematic side view is shown of braid 10 when connected with delivery tube 30 and being deployed from microcatheter 20 in a deployed configuration but prior to being positioned in aneurysm A. The delivery tube 30 can be capable of being distally pushed through the microcatheter 20. Delivery tube 30 can be substantially elongate and can extend from the proximal 26 to the distal end 24 of microcatheter 20. Tube 30 can generally run along the inner lumen of microcatheter 20 and may leave a space between its outer surface and the internal surface of microcatheter 20. In turn, delivery tube 30 and microcatheter 20 may be axially aligned. Delivery tube 30 and microcatheter 20 together can deliver braid 10 to a location of interest (e.g. a lesion site). In certain embodiments, microcatheter 20 can be pre-placed at a level of the aneurysm neck and used to track braid 10 to the lesion. Delivery tube 30 can be in mechanical connection with braid 10 at locking portion 54. Braid 10 may be attached to locking portion 54 by slidable attachment, permanent attachment (e.g. crimped, laser, ultrasonic weld, or other sources of heat, adhesive, or the like) or other detachable attachment approaches. When delivery tube 30 is mechanically attached to braid 10 at locking portion 54, distally translating, sliding, or otherwise moving tube 30 towards the aneurysm A can cause braid 10 to begin moving from a collapsed state within microcatheter 20 to a deployed state external to microcatheter 20 with distal sack of braid 10 for occluding aneurysm A, as discussed more particularly below.

[0058] Braid 10 can include an open distal end 14 and a proximal end 16. Braid 10 can be formed from a self-expanding and invertible multi-filament structure that includes a tubular mesh or braid. The distal sack of braid 10 can be formed during deployment as distal end 14 of

braid 10 slides out of microcatheter 20 and enters the aneurysm A. The mesh of braid 10 can be defined by one or more mesh patterns with mesh openings defined by braided filaments. The mesh of braid 10 can be made of several materials such as deposited thin films. The mesh of braid 10 can include multiple wires, for example, from 4 to 96 wires. The number of wires, angle of wires, and diameter of the wires, can all be factors in controlling material properties of the braid 10, including porosity and flexibility.

[0059] The deployed state of braid 10, including the distal sack of segment 12, can be formed by braid 10 being distally translated from a collapsed state within microcatheter 20 and attached to delivery tube 30 and then being deployed into the aneurysm A, distal of the microcatheter 20. The mesh of braid 10 is configured so that as braid 10 is distally translated and end 14 exits from within microcatheter 20, portions of braid 10, including distal segment 12, can begin to radially expand. As braid 10 is further translated, the segments of braid 10 proximal of segment 12, including central segment 11 and/or proximal segment 13, can also begin expanding, buckling, and/or be caused to invert into braid 10, when inside aneurysm A. The wires can be made from multiple alloys such as a nickel-titanium alloy, cobalt chromium alloys, platinum, nitinol, stainless steel, tantalum, or other alloys, or any other suitable biocompatible materials, or combination of these materials. Also, these materials can be absorbable or non-absorbable by the patient over time. In some embodiments, some or all of braid 10 can be a multi-filament cylindrical mesh made preferably of nitinol with interwoven platinum filaments for radiopacity, or Drawn Filled Tube (DFT) Nitinol with 10 to 40% platinum. The apertures in the mesh of braid 10 can also create a substantially unitary frame work or mesh. Thus, the apertures may be of any size, shape, or porosity, and may be uniformly or randomly spaced throughout the wall of the mesh of braid 10. The apertures can provide the tubular element of braid 10 with flexibility and also assist in the transformation of the mesh from the collapsed state to the expanded, deployed state, and vice versa.

[0060] Turning to FIG. 3, an enlarged schematic side view of the braid 10 of FIGs. 1-2 is shown in a close-up, expanded state. Other portions of the mesh of braid 10 can have different porosities and/or other material properties, including segments 11 and 13 of braid 10. The braid 10 can include several segments, including a generally spherical shaped distal sack associated with segment 12 in the deployed state. Central segment 11 can be in communication with segment 12 and be tapered as it communicates from a relatively elongate portion adjacent

segment 13 to the distal sack of segment 12. In other words, segment 11 can include a tapered portion and an elongate, tubular portion where segment 11 communicates with segment 13. Segment 13 in turn can be substantially elongate and extend proximally from segment 11 to locking portion 54 and/or delivery tube 30, when assembled with microcatheter 20. Segment 13 can have the same diameter as the proximal end of segment 11 or segment 13 can also have a smaller diameter than segment 11. In this respect, braid 10 can include three porous segments, including segments 11, 12, and 13, and each of segments 11, 12, and 13 can have varying flexibility and/or porosity. For example, segment 11, including its tapered portion, can be relatively soft and flexible whereas segment 11 where it communicates with segment 13 can be less flexible with a lower porosity. Varying flexibility and/or porosity in this manner can induce segment 12 to buckle and/or cause segment 11 to invert on itself like a sock as its proximal, stiffer end is distally pushed further into the distal sack of segment 12.

[0061] Segment 11 of the braid 10 can have porosity less than the porosity of segment 13 and/or the segment of sack 12. The porosities associated with segments 11, 12, 13 and/or any other region or segment of braid 10 can include filaments having a different shape than the filaments in the other porosity regions. Segment 13 of the braid 10 similarly can have a porosity or flexibility that differs with those of segments 11 and 13. For example, the porosity of segment 13 can be less than porosities of segment 11 and/or 12. Segment 13 may also be less flexible than segment 11 and/or segment 12 in order to induce braid 10 inversion during delivery and inversion as braid 10 deploys and expands within aneurysm A. Braid 10 can also be made from nitinol with interwoven platinum filaments for radiopacity. Varying properties of segments 11, 12, and 13 can allow the braid 10 to invert on itself (like a sock) as braid 10 is deployed in the aneurysm A.

[0062] To facilitate inversion of the braid 10, including inversion of segment 11 into segment 12, the braid 10 can be modified to weaken segment 12 (e.g. by facilitating buckling of segment 12 after formation of the distal sack inside aneurysm A) or otherwise make segment 11 more likely to invert. For example, braid 10 can include an inflection point 9 disposed between segments 11 and 12 and/or between segments 11 and 13 communicate with each other. Inflection point 9 can be a localized region or can function as a border or separation between each adjoining segment. Inflection point 9 can be a pre-weakened area that induces buckling or inversion of braid 10, as needed or required. Braid 10 is not so limited, however, and other

properties can be modified to induce inversion, including a localized braid angle change, removal of wire segments over the tapered area of segment 11, and/or a localize heat treatment to change braid properties. As illustrated, segments 11, 12, and 13 can be configured so that segment 12 can be caused to buckle about the neck of the aneurysm during deployment so that segment 11 can be inverted into segment 12. This novel braid 10 is particularly advantageous as buckling of segment 12 serves as a safety mechanism that prevents segment 12 from expanding too much and risking rupture of aneurysm A. Inverting segment 11 on or adjacent the neck of the aneurysm A can in turn induce a flow diverting effect across the neck of the aneurysm A. This is because segment 13 can be in communication with the neck of the aneurysm when braid 10 is inverted and deployed in the aneurysm, since end 16 can be tucked into segment 12 (e.g., see FIG. 5B).

[0063] In certain embodiments, a braid angle of one or some of the segments 11, 12, 13 of braid 10 can vary with respect to a longitudinal axis of the braid 10. The wire diameter, pick count (i.e. the number of wire crossovers per lineal measurement) of braid 10 can also vary or otherwise be modified between segments of braid 10 to change the device characteristics as well as the heat set shape. The diameter of the braid 10 in the deployed state, including the expanded diameter of the distal sack of segment 12, and the braid wire count can vary depending of the distal sack diameter needed to treat the aneurysm A. However, braid 10 is not so limited and it can have a braid angle, pitch count, wire diameter, porosity or any other property of braid 10 that is substantially similar throughout. The fibers of braid 10 can be formed by being fastened at their free ends at end 16 by heat bonding by laser or ultrasonic weld, solvent or adhesive binding, crimping, or any other attachment means. The fibers of each segment of braid 10 may be bonded at their internal crossover points by solvent, adhesive, or heat bonding like laser, ultrasonic weld, or any other source of heat to decrease the flexibility in certain segments of braid 10.

[0064] FIGs. 4A to 5B depict an enlarged schematic side view of braid 10 attached to delivery tube 30 and partially disposed in microcatheter 20 as the braid 10 is being pushed from microcatheter 20 into an example aneurysm A. The outer diameter of segment 12 is illustrated in FIGs. 4A to 5B radially expanding to a diameter greater than the microcatheter 20 as the distal sack is formed (e.g., greater than twice the diameter of the microcatheter 20). As illustrated in FIG. 4A, segment 12 of braid 10 has expanded from being in a collapsed state disposed inside microcatheter 20 to a deployed state, distal of the microcatheter 20 and beginning to form the

distal sack of segment 12 inside aneurysm A. The assembly between microcatheter 20, delivery tube 30, and/or braid 10 can take place before being introduced into the vasculature. the distal sack of segment 12 is illustrated radially expanding towards the outer walls of aneurysm A while segments proximal thereof (e.g. segments 11, 13) continue to be distally translated by delivery tube 30 deeper into the aneurysm A. Segment 12 in FIG. 4A is beginning to take a generally spherical shape internal to aneurysm A as braid 10 is translated distally into aneurysm A, further away from catheter 20.

[0065] In FIG. 4B, delivery tube 30 distally moves deeper into the aneurysm A. In turn, the inflection point 9 disposed between segments 11 and 12 causes segment 12 to buckle. By buckling, the portions of segment 12 adjacent the neck of aneurysm A are caused to bend or otherwise contour distally away from inflection point 9. As illustrated, portions of segment 12 bow about segment 11 to the desired expanded, occlusion setting after segment 12 has buckled.

[0066] In FIG. 5A, delivery tube 30 is further distally pushed into aneurysm A until segment 11 is fully within the distal sack of segment 12 and end 16, including locking portion 54, is at or adjacent the level of the neck of aneurysm A. In FIG. 5A, segment 11 has inverted as a result of moving distally deeper into aneurysm A after segment 12 buckled in FIG. 4B. In one example, the inversion of segment 11 into segment 12 can occur when the end 14, or extents of segment 12 of the braid 10 is relatively fixed against the wall of aneurysm A while delivery tube 30 distally pushes away from microcatheter 20. Segment 12 is also illustrated having expanded from an unexpanded state pre-deployment to the sack depicted FIG. 4B and this expansion is caused by delivery tube 30 being driven distally. Delivery tube 30 may be driven by a hypotube from its proximal end 36 by an operator or the like. The inversion of braid 10 at segments 11 and 13 can be similar to how a tube sock is configured to invert into itself. Upon inversion of segment 11 into segment 12, delivery tube 30 can continue distally pushing segment 13 into segment 11 as shown. In particular, segment 13 can be tucked into segment 11 in the deployed state. In certain embodiments, as segment 13 is distally tucked deeper into segment 11, segment 11 is caused to taper at the junction between segment 11 and segment 12. In certain embodiments, as this tapering occurs, proximal portions of segment 12 on or adjacent the neck are caused to blend and/or contour with the neck of the aneurysm thereby inducing a flow diverting effect in the vasculature.

[0067] In certain embodiments, segment 13 may only be structurally capably of tucking into segment 11 a predetermined distance and thus prevented from being tucked any deeper into the aneurysm A. For example, segment 13 may be capable of being tucked until the inflection point 9 of segments 11 and 12 is disposed on or adjacent the neck of the aneurysm. This serves as an additional safety feature of braid 10 since the distal sack of segment 12 would be prevented from expanding beyond a predetermined diameter. As illustrated in FIG. 5A, the inflection point 9 between segments 11 and 12 is illustrated disposed on or adjacent the neck of the aneurysm A, while the second inflection point 9 between segments 11 and 13 is disposed deeper in the aneurysm A (e.g., centrally located therein). . In this respect, segment 11 is now completely inverted into the distal sack of 12 while segment 13 is completely inverted into segment 12.Locking portion 54, and/or portions of delivery tube 30 can be at the level of the neck of the aneurysm A as seen under fluoroscopy. Delivery tube 30 can distally slide braid 10 until end 16 and/or locking portion 54 are tucked into the aneurysm A.

[0068] Microcatheter 20 may remain relatively stationary or fixed during the example delivery shown in FIGs. 4A-5B. Since segments 11, 12, and 13 can include different braid properties, including flexibility and/or porosity, inverting segment 11 into segment 12 and/or tucking segment 13 into inverted segment 11 is particularly advantageous. For example, inversion of segment 11 and/or tucking segment 13 prevents braid 10 from creating a protrusion that would otherwise extend into the parent vessel. Instead, any such protrusion is now inverted and tucked into the distal sack of braid 10 in the aneurysm A. Inverting segment 11 and/or tucking segment 13 can also prevent braid 10 from otherwise rupturing the aneurysm A when moving to the deployed state.

[0069] It is understood that inflection points 9 may be formed into the interstices of braid 10 between segments 11, 12, 13 so that buckling of segment 12 and/or inversion of segment 11 occurs after braid 10 has distally translated a predetermined distance outside of microcatheter 20. For example, distally translating braid 10 a first distance, with respect to the aneurysm A, can cause segment 12 to buckle about the neck of the aneurysm. Distally translating the braid a second distance, with respect to the aneurysm A, can cause segment 11 to invert into segment 12. Points 9 may be one or more weakened regions, areas, or buckling points pre-set for a particular sized distal sack. Alternatively, no inflection points 9 may be included and instead braid 10 may buckle, invert and fold into itself upon end 14 of braid contacting the

dome of aneurism A (e.g. based on pre-selected flexibility of braid 10 and/or heat setting the braid in a particular manner).

[0070] Once segments 11, 12, and 13 are selectively positioned and arranged to the desired condition (e.g. braid 10 has been translated distally into aneurysm A to expand segment 12 to form its sack, buckle, segment 11 has been inverted, and segment 13 tucked therein), braid 10 can be detached from the delivery tube 30 as shown in FIG. 5B. In particular, FIG. 5B illustrates the distal sack of segment 12 fully formed in a manner sufficient to occlude aneurysm A. However, if the sack of segment 12 is not precisely positioned or if segment 12 and/or any internally disposed segments proximal thereto need to be reset or adjusted within aneurysm A, braid 10, including segments 11, 12, and 13, can be retracted back into microcatheter 20 by proximally withdrawing delivery tube 30 back into microcatheter 20 while still attached to braid 10. In FIG. 5A, since the sack of segment 12 has been selectively positioned and formed within aneurysm A, delivery tube 30 can be proximally translated back into microcatheter 20 and both can be retracted from the braid 10 and aneurysm A.

[0071] FIGs. 6A to 7B generally illustrate example attachment and delivery between delivery tube 30 and braid 10 for deploying and detaching braid 10 in aneurysm A. The embodiments of FIGs. 6A to 7B is merely one way that delivery tube 30 and braid 10 may be attached at end 34 and any number of attachment means are contemplated as needed or required. The delivery tube 30 as shown can have a lumen extending from a proximal end 36 to a distal, delivery end 34. FIG. 6A illustrates braid 10 engaged with the locking member 52 and loop wire 58 locked into the locking portion 54. The opening 59 of the loop wire 58 can be placed through the locking portion 54. The locking portion 54 preferably takes the form of a small diameter elongate filament, however, other forms such as wires or tubular structures are also suitable. While the locking portion 54 is preferably formed of nitinol, other metals and materials such as stainless steel, PTFE, nylon, ceramic or glass fiber and composites may also be suitable. Locking member 52, in one example, may be an elongated retractable fiber that may extend between ends 24 and 26 of the microcatheter 20. Locking member 52 preferably takes the form of a small diameter elongate filament, however, other forms such as wires or tubular structures are also suitable. While the locking member 52 is preferably formed of nitinol, other metals and materials such as stainless steel, PTFE, nylon, ceramic or glass fiber and composites may also be suitable. When the locking member 52 is put through the opening 59 the braid 10 is now secure.

It is understood that delivery tube 30 may include a compressible portion 38 disposed between its ends 34 and 36.

[0072] The compressible portion 38 can allow the delivery tube 30 to bend and/or flex. Such flexibility can assist tracking the braid 10 through the microcatheter 20 and the tortuous path through the vasculature. The compressible portion 38 can be formed with interference spiral cuts that can allow for gaps to permit bending but in one example, do not act as a spiral-cut spring. Compressible portion 38 can be axially adjustable between an elongated condition and a compressed condition. However, any other arrangement allowing axial adjustment (e.g., a wound wire or spiral ribbon) can also be suitable for use with detachment systems according to the present disclosure). The compressible portion 38 can be in the elongated condition at rest and automatically or resiliently returns to the elongated condition from a compressed condition, unless otherwise constrained. The function of the compressible portion 38 is described in greater detail herein.

[0073] A force F was previously applied to place the delivery tube 30 in a compressed state. FIG. 6B illustrates the locking member 52 being drawn proximally to begin the release sequence for braid 10. FIG. 7A illustrates the instant the locking member 52 exits the opening 59 and is pulled free of the loop wire 58. The distal end 62 of the loop wire 58 falls away/returns to its preformed shape and exits the locking portion 54. As can be seen, there is now nothing holding the braid 10 to the delivery tube 30. FIG. 7B illustrates the end of the release sequence. Here, the compressible portion 38 of the delivery tube 30 has expanded/returned to its original shape and "sprung" forward. An elastic force E is imparted by the distal end 34 of the delivery tube 30 to the braid 10 to "push" it away to insure a clean separation and delivery of the braid 10 to the aneurysm A. It is to be understood that the delivery scheme described in FIGs. 6A-7B are merely example approaches to delivery of braid 10.

[0074] FIG. 8 is a flow diagram for a method 800 of occluding an aneurysm. Step 805 includes selectively positioning a braid at or adjacent a neck of the aneurysm. Step 810 includes distally sliding the braid into the aneurysm. Step 815 includes radially expanding a distal segment of the braid to form a distal sack inside the aneurysm, the distal sack configured to occlude the aneurysm. Step 820 includes further distally sliding the braid into the aneurysm thereby buckling the distal segment buckle about the neck of the aneurysm. Step 825 includes further distally sliding the braid into the aneurysm thereby inverting a central segment of the

braid into the distal segment. Step 830 includes tucking a proximal segment of the braid into the central segment. Step 835 includes releasing the braid within the aneurysm.

[0075] Method 800 can also include tucking the proximal segment into the central segment until the proximal segment is adjacent or in communication with the neck of the aneurysm; and inducing a flow diverting effect across the neck of the aneurysm. Method 800 can also include positioning a first inflection point between the distal segment and the central segment; positioning a second inflection point between the central segment and the proximal segment; buckling the distal segment about the neck of the aneurysm, by the first inflection point, when distally translating a proximal end of the braid a first distance with respect to the neck of the aneurysm; and inverting the central segment into the distal segment, by the second inflection point, by distally translating the proximal end of the braid a second distance with respect to the neck of the aneurysm.

[0076] Method 800 can also include forming the central segment with a porosity greater than a porosity of the proximal and distal segments; and forming the porosity of the distal segment greater than the porosity of the proximal segment, or vice versa. Method 800 can also include inverting the central segment into the distal segment, by the second inflection point, which causes the central segment to tuck into the distal segment.

[0077] FIG.9 is a flow diagram for a method 900 of occluding an aneurysm. Step 905 can include positioning a braid with the delivery tube, the braid being in a collapsed state with the microcatheter. Step 910 can include selectively positioning the microcatheter, the delivery tube, and the braid at or adjacent the neck of the aneurysm. Step 915 can include distally sliding the braid, by the delivery tube, from the microcatheter into the aneurysm. Step 915 can include radially expanding a distal segment of the braid to form a distal sack inside the aneurysm, the distal sack configured to occlude the aneurysm. Step 920 can include further distally sliding the braid, by the delivery tube, thereby buckling the distal segment about the neck of the aneurysm. Step 930 can include further distally sliding the braid, by the delivery tube, thereby inverting a central segment of the braid proximal the distal segment into the distal sack. Step 935 can include tucking a proximal segment proximal the central segment into the central segment. Step 940 can include releasing the braid within the aneurysm and withdrawing the delivery tube and the microcatheter from the aneurysm.

[0078] The method 900 can also include positioning a first inflection point between the distal segment and the central segment; positioning a second inflection point between the central segment and the proximal segment; buckling the distal segment about the neck of the aneurysm, by the first inflection point, by distally translating a proximal end of the braid a first distance with respect to microcatheter; and inverting the central segment into the distal segment, by the second inflection point, by distally translating the proximal end of the braid a second distance with respect to the microcatheter.

[0079] The method 900 can also include inverting the central segment into the distal sack which creates a flow diverting effect across the neck of the aneurysm. The method 900 can also include forming each of the proximal, distal, and central segments with a different porosity. The method 900 can also include forming the central segment with a porosity greater than a porosity of the proximal and distal segments; and forming the porosity of the distal segment greater than the porosity of the proximal segment, or vice versa. The method 900 can also include tucking the proximal segment into the central segment until the proximal segment is adjacent or in communication with the neck of the aneurysm; and inducing a flow diverting effect across the neck of the aneurysm.

[0080] It is understood that variations of the braid 10 can include various materials such as nitinol. stainless steel, bio absorbable materials, and polymers. The braid wire count of interstices of braid 10 that may form the expandable and invertible mesh can vary depending of the diameter of the sack of segment 12 and/or segments proximal thereof and/or inverted internal thereto. For example, to induce formation of the predetermined shape and strength of the distal sack of braid 10, end 14 can be opened and/or be capable of allowing for sizing or conforming to the aneurysm A. For example, if the aneurysm is relatively small, distal end 14 may close in on itself, whereas in a larger aneurysm the same braid 10 would remain open. Other segments of braid 10, including segments 11 and 13, may vary from most pliable on or about end 14 and less pliable on or about end 16. Interstices of braid 10 may also form small openings for occlusion of the aneurysm.

[0081] Braid 10, including any specific portions such as any breaks, inflection points, porosities, flexibilities, and/or corresponding sack(s), can be heat set to various configurations such as spherical, oblong, saddle shaped, etc. for the purpose of shaping the initial sack to better match the aneurysm morphology. It is also understood that any sack formed by the herein

discussed braid 10 can be in a spherical shape as depicted or any other shape, as needed or required, such as ellipsoidal, heart-shaped, ovoid, cylindrical, hemispherical, or the like. Further, interstices of braid 10 that form the sack can vary, or be selectively designed, in size or shape along its length depending on how much braid 10 is caused to radially expand as delivery tube 30 is distally moved.

[0082] The specific configurations, choice of materials and the size and shape of various elements can be varied according to particular design specifications or constraints requiring a system or method constructed according to the principles of the disclosed technology. Such changes are intended to be embraced within the scope of the disclosed technology. The presently disclosed embodiments, therefore, are considered in all respects to be illustrative and not restrictive. It will therefore be apparent from the foregoing that while particular forms of the disclosure have been illustrated and described, various modifications can be made without departing from the spirit and scope of the disclosure and all changes that come within the meaning and range of equivalents thereof are intended to be embraced therein.

CLAIMS

What is claimed is:

1. A braid for treating an aneurysm, the braid comprising a proximal end and a distal end, the braid comprising:

a distal segment disposed about the distal end, the distal segment operable to transition from a collapsed state within a microcatheter to a deployed state distal of the microcatheter whereby the distal segment radially expands to form a distal sack;

a central segment in communication with the distal segment, wherein the central segment is capable of inverting into the distal sack; and

a proximal segment in communication with the central segment and disposed about the proximal end, wherein the proximal segment is capable of being tucked into the central segment in the deployed state;

wherein each of the proximal, distal, and central segments comprise a different porosity or a different flexibility.

2. The braid of claim 1, further comprising an inflection point disposed between the central segment and the distal segment, wherein the proximal end is configured to be tucked inside the distal sack in the deployed state until the central segment is inverted so the inflection point is disposed adjacent the neck of the aneurysm to induce a flow diverting effect.

3. A braid for treating an aneurysm, the braid comprising a proximal end and a distal end, the braid comprising:

a distal segment disposed about the distal end, the distal segment operable to transition from a collapsed state within a microcatheter to a deployed state distal of the microcatheter whereby the distal segment radially expands to form a distal sack; and

a proximal segment disposed about the proximal end, wherein the proximal segment is capable of inverting and being tucked into the distal sack.

4. The braid of claim 3, wherein the proximal segment comprises a porosity greater than a porosity of the distal segment.

5. The braid of claim 4, wherein the proximal end is configured to be tucked inside the distal sack in the deployed state until a proximal end of the distal segment is disposed adjacent the neck of the aneurysm to induce a flow diverting effect.

6. The braid of claim 3, further comprising: an inflection point disposed between the proximal and distal segments.

7. The braid of claim 6, wherein the proximal segment is configured to be inverted when the inflection point is distal of the microcatheter or is configured to be inverted by the inflection point when the braid has been translated distally a predetermined distance.

8. The braid of claim 3, wherein the distal sack has a diameter at least two times greater than the microcatheter.

9. The braid of claim 3, further comprising a central segment disposed between the proximal and distal segments.

10. The braid of claim 9, wherein each of the proximal, distal, and central segments comprise a different porosity.

11. The braid of claim 10, wherein the central segment comprises a porosity greater than a porosity of the proximal and distal segments; and

wherein the porosity of the distal segment is greater than the porosity of the proximal segment.

12. The braid of claim 10, further comprising:

a first inflection point disposed between the distal segment and the central segment; and

a second inflection point disposed between the central segment and the proximal segment.

13. The braid of claim 12, wherein in the deployed state, the first inflection point is configured to cause the proximal end of the distal segment to buckle when the braid is distally translated a first distance; and

wherein in the deployed state, the second inflection point is configured to cause the central segment to invert into the distal segment when the braid is distally translated a second distance.

14. The braid of claim 12, wherein in the deployed state, the first inflection point is configured to cause the proximal end of the distal segment to buckle about the neck of the aneurysm; and

wherein in the deployed state, wherein the second inflection point is configured to cause the central segment to invert into the distal segment.

15. The braid of claim 12, wherein when the first inflection point is distal of the microcatheter, the first inflection point is configured to cause the proximal end of the distal segment to buckle about the neck of the aneurysm;

when the second inflection point is distal of the microcatheter, the second inflection point is configured to cause the central segment to invert into to the distal segment and the proximal segment tuck into the central segment.

16. The braid of claim 12, wherein the proximal and/or central segment are/is configured to be tucked inside the distal sack in the deployed state until the first inflection point is disposed adjacent the neck of the aneurysm to induce a flow diverting effect.

17. A method of occluding an aneurysm, comprising:

selectively positioning a braid at or adjacent a neck of the aneurysm;

distally sliding the braid into the aneurysm;

radially expanding a distal segment of the braid to form a distal sack inside the aneurysm, the distal sack configured to occlude the aneurysm;

further distally sliding the braid into the aneurysm thereby buckling the distal segment buckle about the neck of the aneurysm;

further distally sliding the braid into the aneurysm thereby inverting a central segment of the braid into the distal segment;

tucking a proximal segment of the braid into the central segment; and

releasing the braid within the aneurysm.

18. The method of claim 17, further comprising:

tucking the proximal segment into the central segment until an inflection point between the distal segment and the central segment is adjacent or in communication with the neck of the aneurysm; and

inducing a flow diverting effect across the neck of the aneurysm.

19. The method of claim 17, further comprising:

positioning a first inflection point between the distal segment and the central segment;

positioning a second inflection point between the central segment and the proximal segment;

buckling the distal segment about the neck of the aneurysm, by the first inflection point, when distally translating a proximal end of the braid a first distance with respect to the neck of the aneurysm; and

inverting the central segment into the distal segment, by the second inflection point, by distally translating the proximal end of the braid a second distance with respect to the neck of the aneurysm.

20. The method of claim 19, wherein inverting the central segment into the distal segment, by the second inflection point, causes the central segment to tuck into the distal segment

ABSTRACT

The present disclosure relates to a braid for treating an aneurysm. The braid can include a distal end opposite a proximal end. Translating the braid can cause the delivery portion to expand and form a distal sack as well as invert into itself.

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Application Number	Not Yet Assigned
Filing Date	Filed Concurrently Herewith
First Named Inventor	Lacey GOROCHOW
Title	ANEURYSM DEVICE AND DELIVERY SYSTEM
Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned
Attorney Docket Number	243382.000067

SIGNATURE of Applicant or Patent Practitioner

Signature	/Louis J. DelJuidice - 47,522/	Date (Optional)	2018-05-31
Name	Louis John DelJuidice	Registration Number	47522
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	DePuy Synthes Products, Inc.		

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☐ Inventor or Joint Inventor (title not required below)

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The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/Eugene L. Szczecina, Jr./	Date (Optional)	August 30, 2016
Name	Eugene L. Szczecina, Jr.		
Title	Assistant General Counsel – Patents / DePuy Synthes Products, INC.		

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☒ The attached application, or
- ☐ United States application or PCT international application number _____

  filed on _____.

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

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

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

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Juan LORENZO Date (Optional) : _____

Signature: _____ Digitally signed by JUAN LORENZO
DN: c=US, o=JNJ, ou=Subscribers, cn=JUAN LORENZO, 0.9.2342.19200300.100.1.1=118229
Reason: I attest to the accuracy and integrity of this document
Date: 2018.05.29 09:52:54 -04'00'
Adobe Acrobat version: 11.0.10

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

PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [■] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

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

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

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

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Lacey GOROCHOW Date (Optional): 5-25-2018

Signature: _____

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

PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [■] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

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

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

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

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

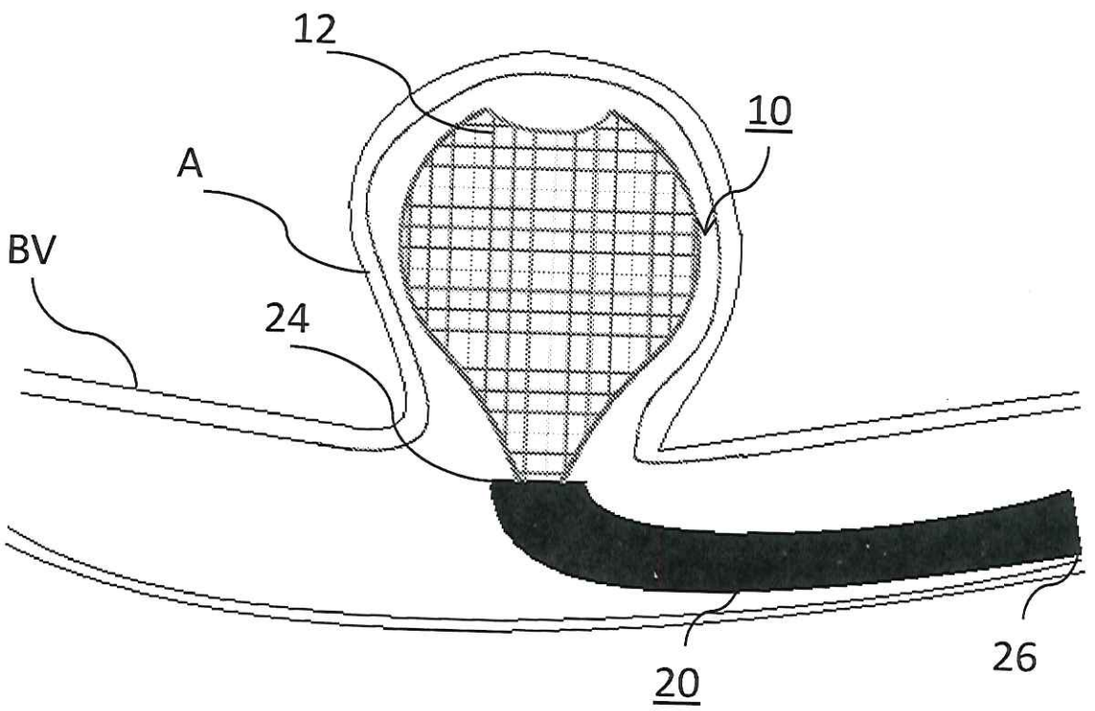
LEGAL NAME OF INVENTOR

Inventor: Ariel SOTO DEL VALLE Date (Optional): 5/30/18

Signature: _____

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

FIG. 1



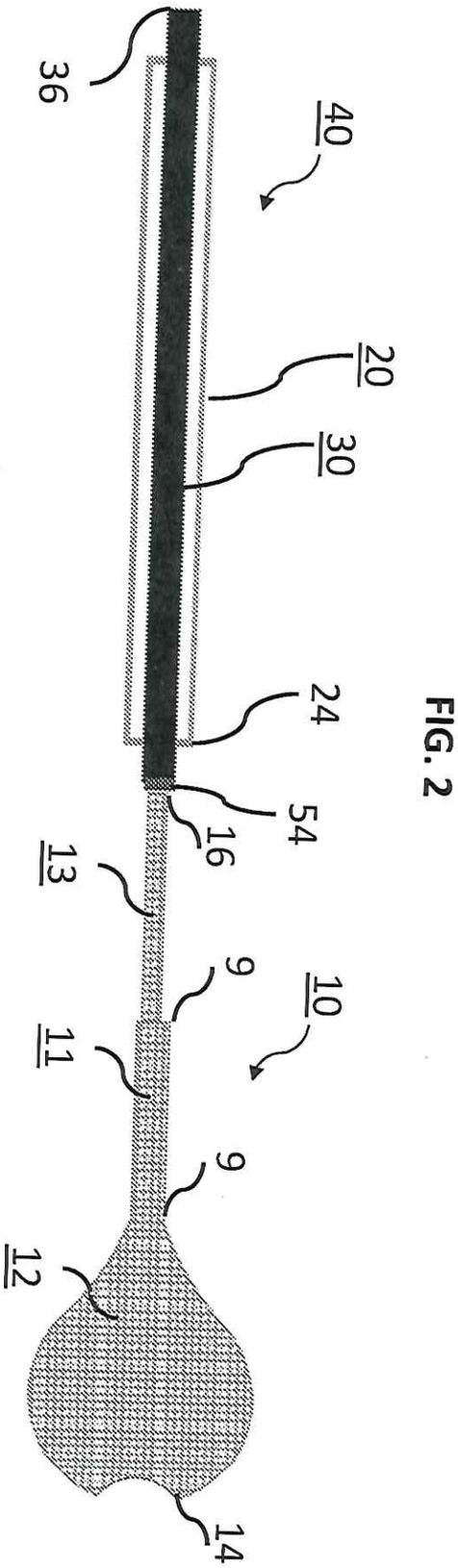


FIG. 2

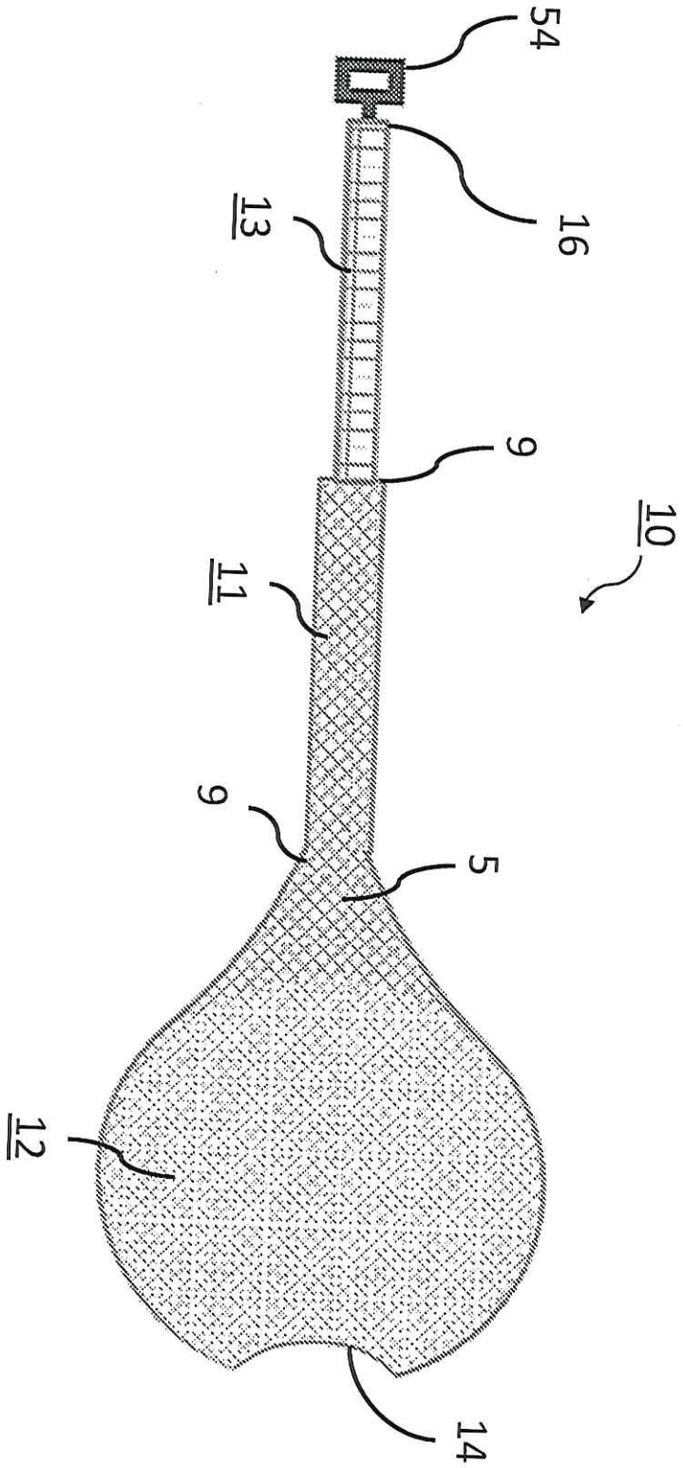


FIG. 3

FIG. 4A

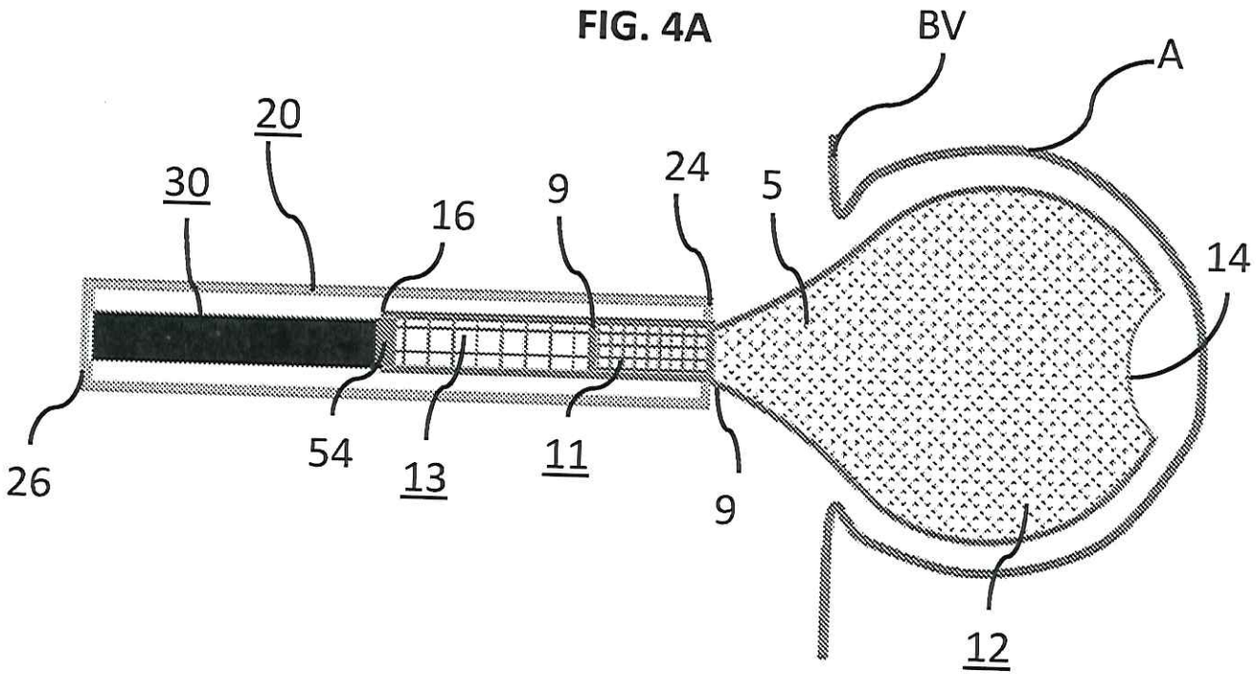


FIG. 4B

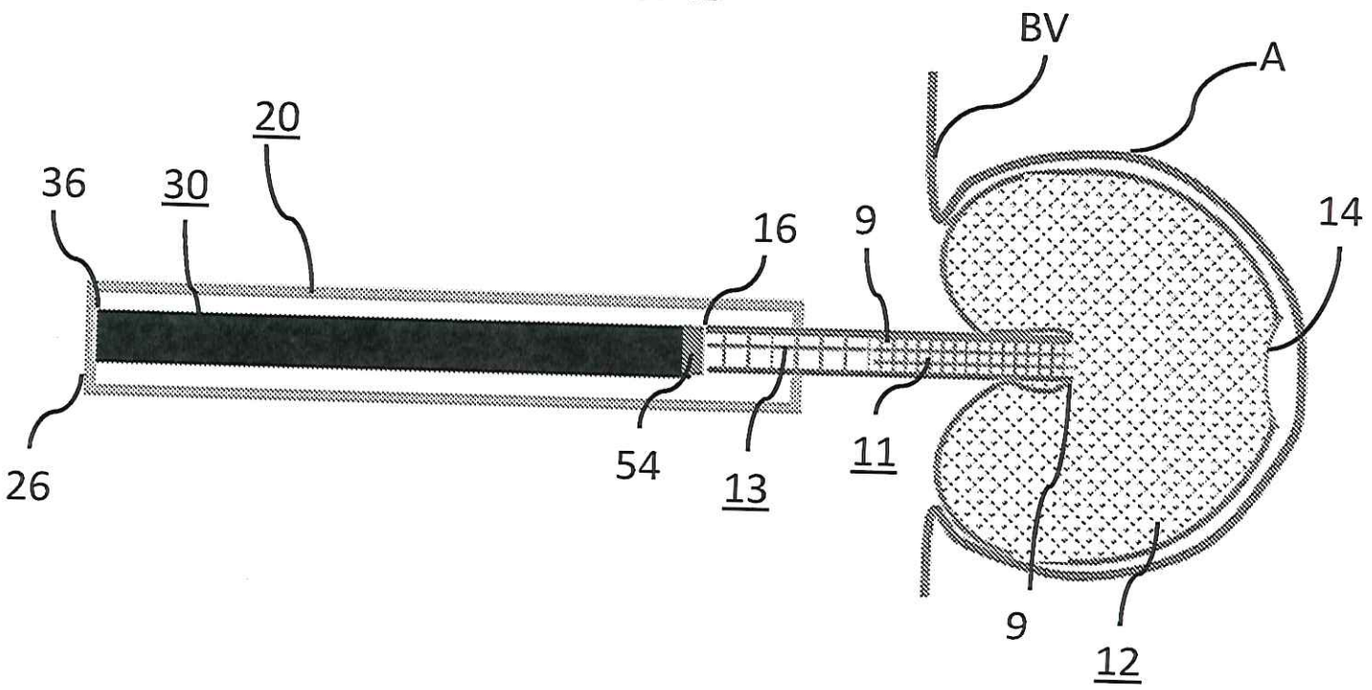


FIG. 5A

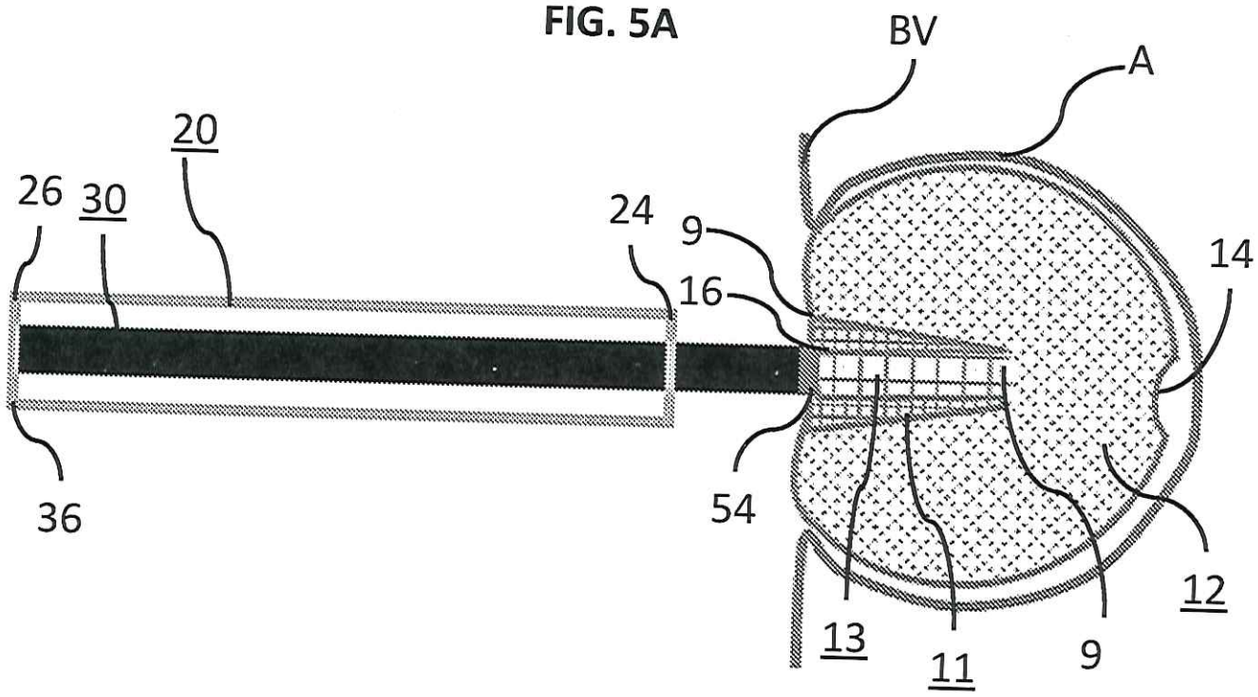


FIG. 5B

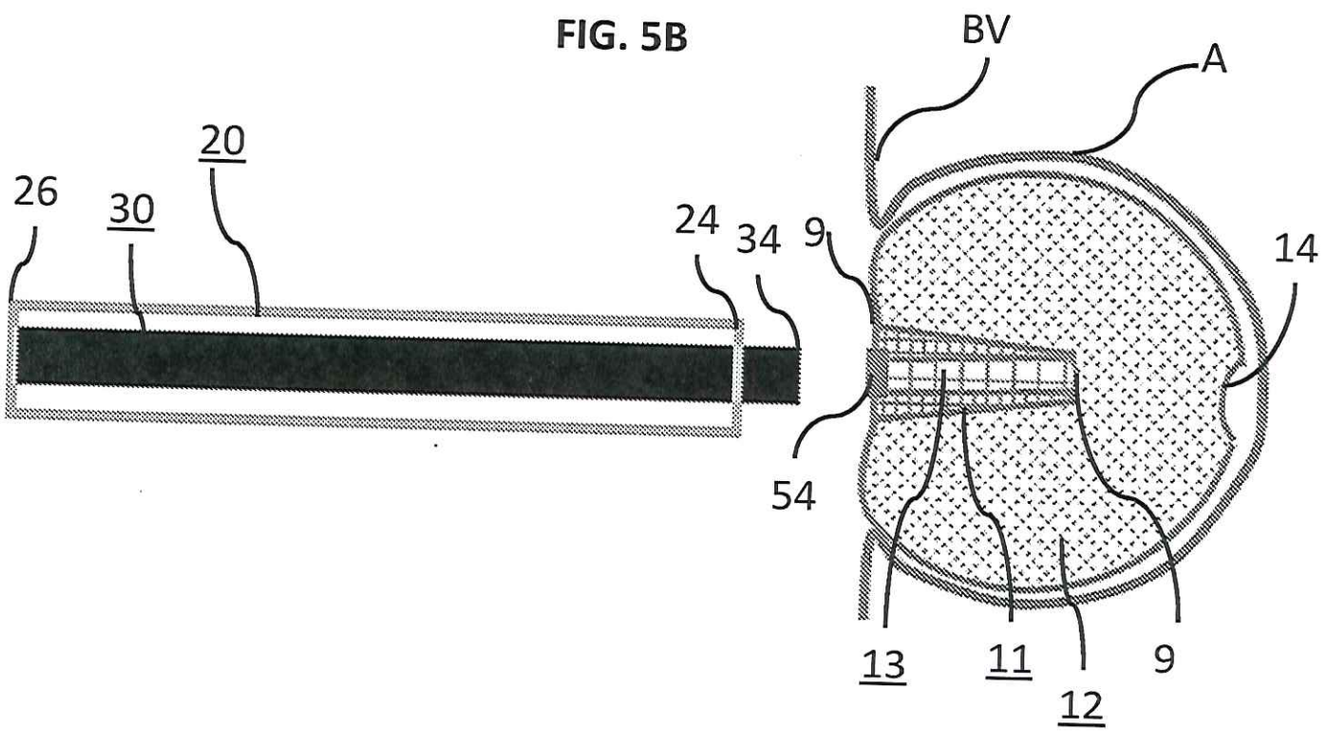


FIG. 6A

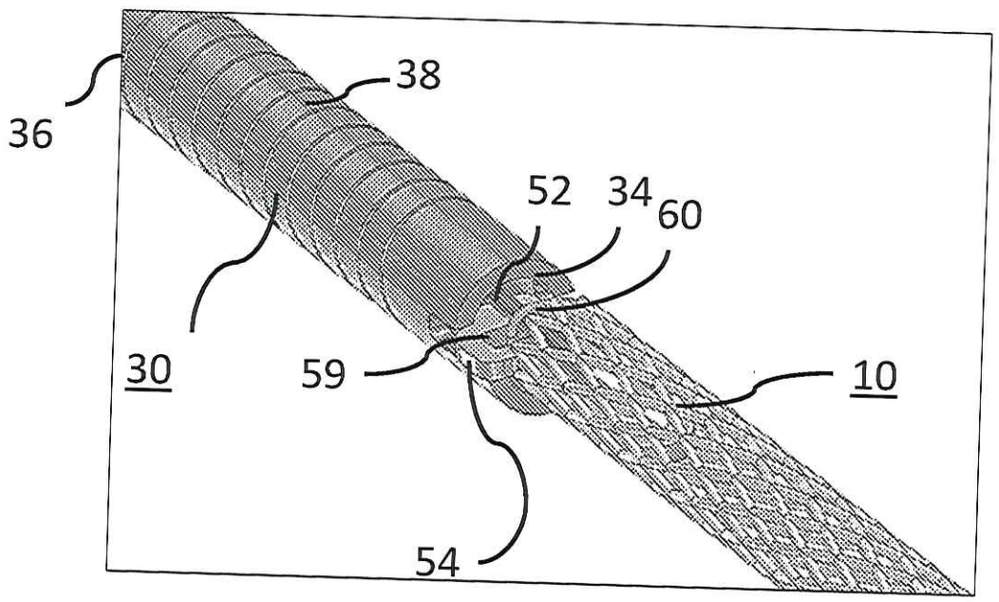


FIG. 6B

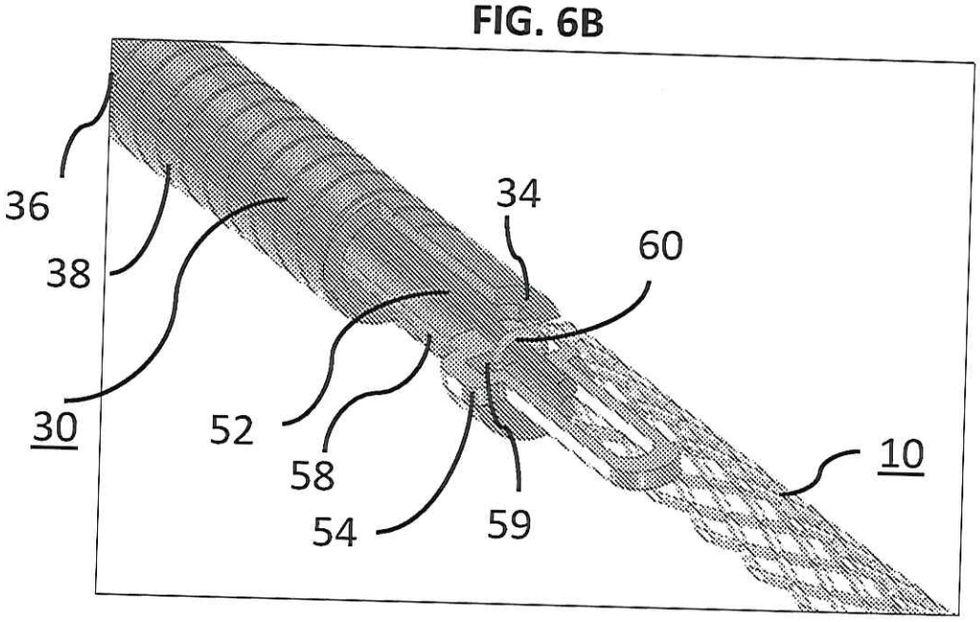


FIG. 7A

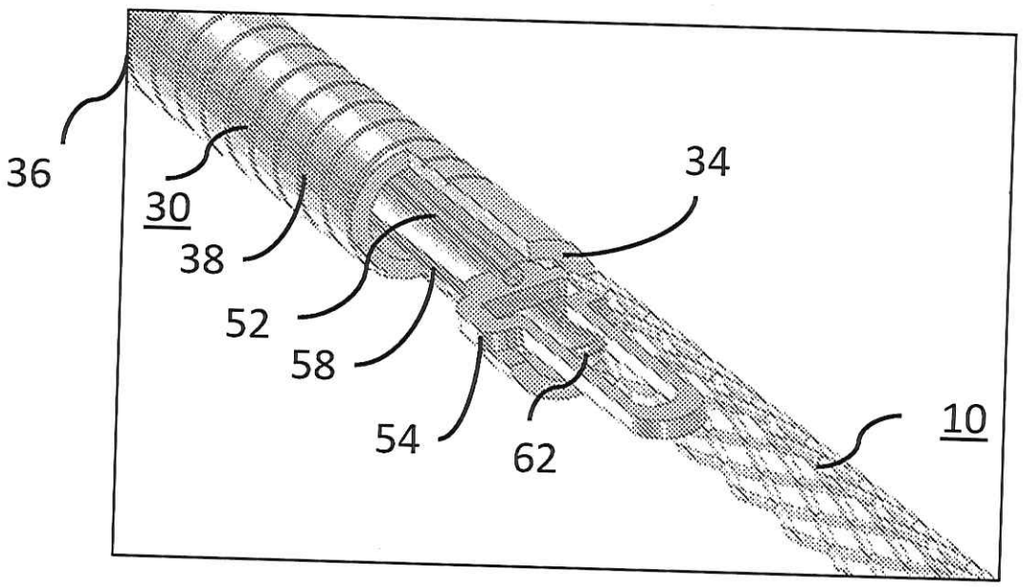
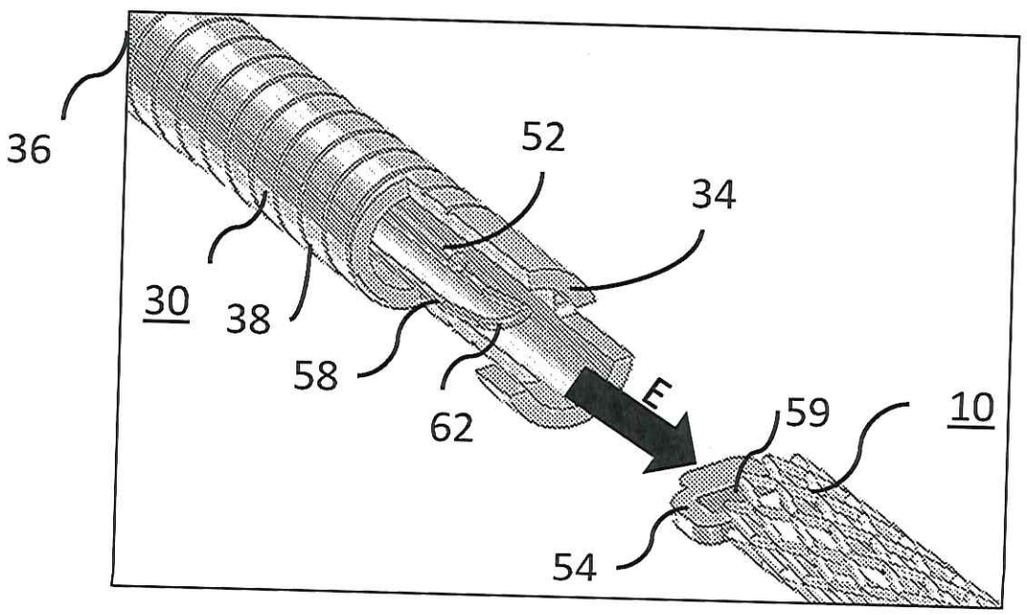
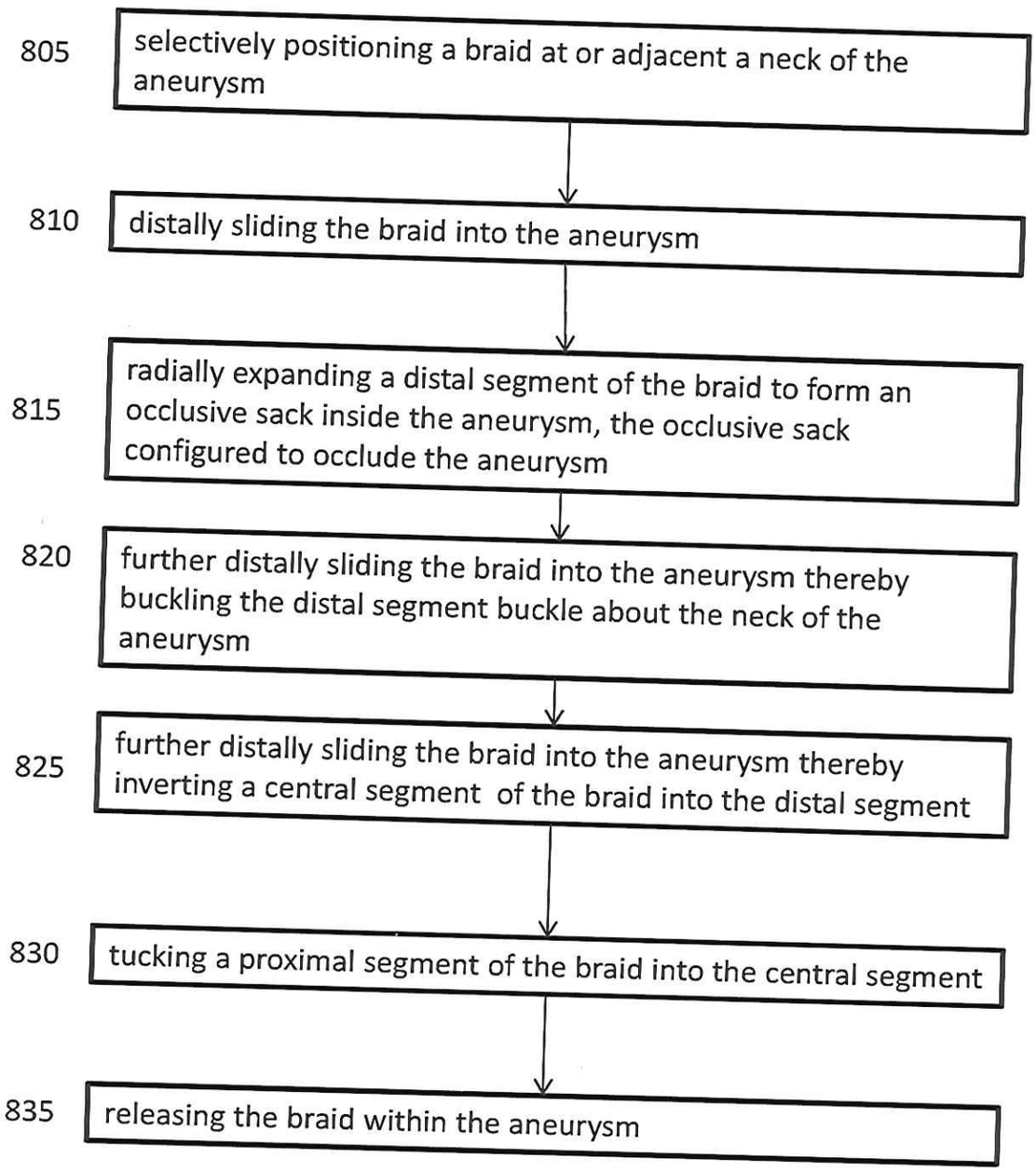


FIG. 7B



800

FIG. 8



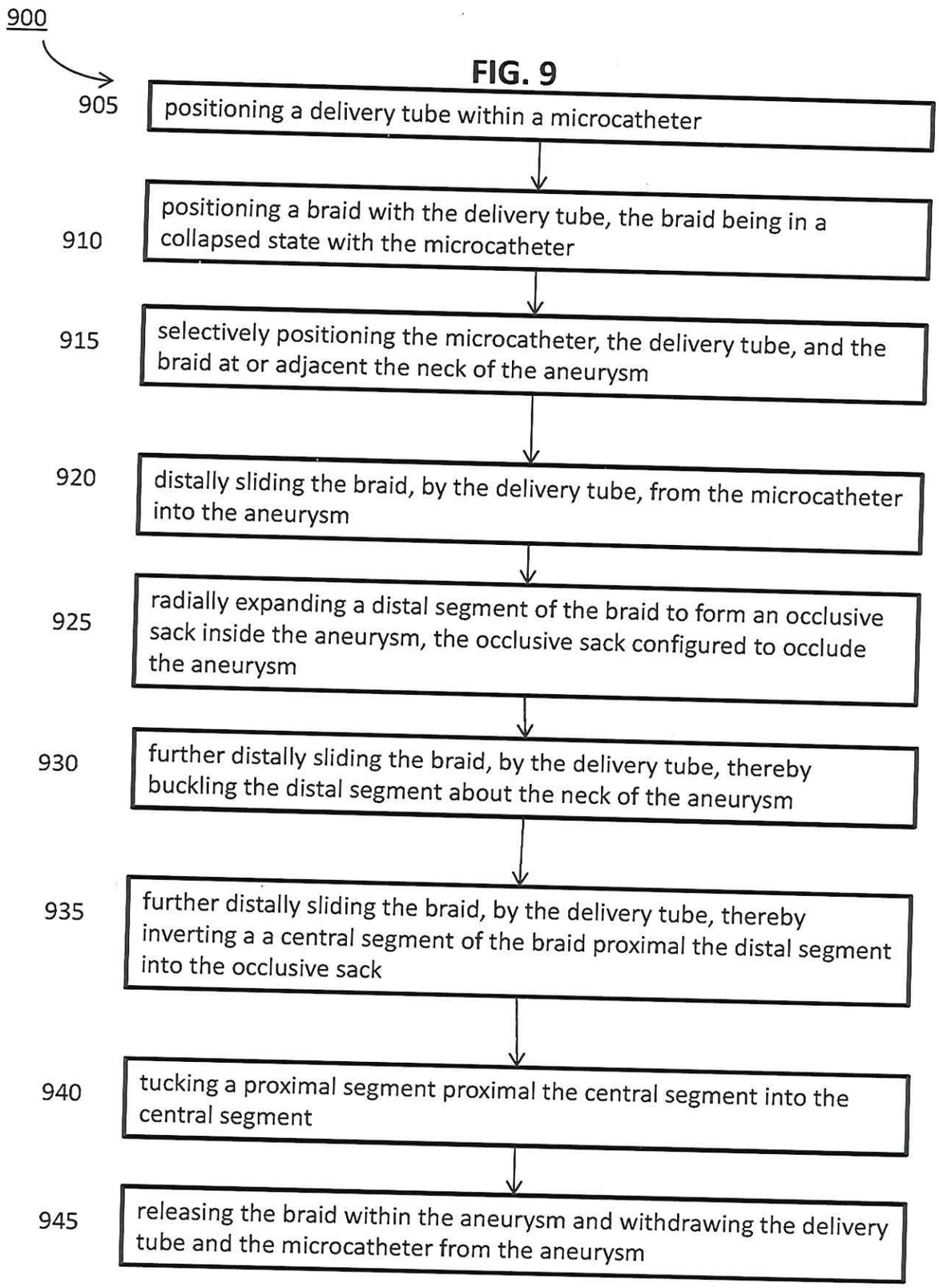


FIG. 9

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

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

Secrecy Order 37 CFR 5.2:

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

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Lacey		GOROCHOW	

Residence Information (Select One) ● US Residency ○ Non US Residency ○ Active US Military Service

City	State/Province	Country of Residence
Raynham	MA	US

Mailing Address of Inventor:

Address 1	c/o DePuy Synthes Products, Inc.
Address 2	325 Paramount Drive
City	Raynham
State/Province	MA
Postal Code	02767
Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ariel		SOTO DEL VALLE	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	State/Province	Country of Residence
Raynham	MA	US

Mailing Address of Inventor:

Address 1	c/o DePuy Synthes Products, Inc.
Address 2	325 Paramount Drive
City	Raynham
State/Province	MA
Postal Code	02767
Country	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Juan		LORENZO	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

City	Raynham	State/Province	MA	Country of Residence	US

Mailing Address of Inventor:

Address 1	c/o DePuy Synthes Products, Inc.		
Address 2	325 Paramount Drive		
City	Raynham	State/Province	MA
Postal Code	02767	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	06980		
Email Address	IPServicesNYC@troutmansanders.com	Add Email	Remove Email

Application Information:

Title of the Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM		
Attorney Docket Number	243382.000067	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	9	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	06980		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Remove Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	DePuy Synthes Products, Inc.		
Mailing Address Information For Applicant:			
Address 1	325 Paramount Drive		
Address 2			
City	Raynham	**State/Province**	MA
Country	US	Postal Code	02767
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

Organization Name	DePuy Synthes Products, Inc.

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	325 Paramount Drive		
Address 2			
City	Raynham	**State/Province**	MA
Country i	US	Postal Code	02767
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Louis J. DelJuidice - 47,522/			Date (YYYY-MM-DD)	2018-05-31
First Name	Louis John	Last Name	DelJuidice	Registration Number	47522

Additional Signature may be generated within this form by selecting the Add button. Add

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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000067
	Application Number	
Title of Invention	ANEURYSM DEVICE AND DELIVERY SYSTEM	

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

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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