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7 de agosto 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 DICHS 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: 16/056.135

FECHA DE PRESENTACIÓN: 6 de agosto de 2018

EL CÓDIGO DE PAÍS Y EL NÚMERO DE SU SOLICITUD DE PRIORIDAD, QUE SE USARÁN PARA LA PRESENTACIÓN EN EL EXTRANJERO EN VIRTUD DE LA CONVENCION DE PARÍS, SONUS16/056.135

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



W. Montgomery
W. MONTGOMERY
Funcionario certificador

REIVINDICACIONES

Reivindicaciones:

1. Un implante trenzado configurado como un desviador de flujo para tratar un aneurisma, el implante comprende:

5 una malla trenzada configurada para mantener una porosidad objetivo sustancialmente consistente en un vaso estrechado de un rango de diámetro de vaso de hasta 1 mm;

en donde la malla trenzada se configura para mantener la porosidad objetivo sustancialmente consistente entre los extremos proximal y distal de la malla trenzada
10 mientras está en el vaso estrecho.

2. El implante de la reivindicación 1, en donde el vaso estrechado comprende un diámetro de extremo proximal y un diámetro de extremo distal que difieren por 1 mm, en donde el rango de diámetro de vaso de hasta 1 mm se define comparando los
15 diámetros del extremo proximal y distal.

3. El implante de la reivindicación 1, en donde la porosidad objetivo sustancialmente consistente es aproximadamente 70 %.

20 4. El implante de la reivindicación 1, en donde una longitud predeterminada entre los extremos proximal y distal de la malla trenzada en el vaso estrechado tiene al menos 3 cm.

5. El implante de la reivindicación 1, en donde una longitud predeterminada entre los extremos proximal y distal de la malla trenzada en el vaso estrechado es de al menos 1 cm.

5 6. El implante de la reivindicación 1, en donde el implante trenzado comprende, además, un diámetro de vaso indicado, y en donde el implante trenzado se configura de manera que el diámetro de vaso indicado coincida con un pico de una curva de porosidad del implante trenzado.

10 7. El implante de la reivindicación 6, en donde el implante comprende, además, una meseta de porosidad que corresponde a un rango radial de 1 mm en un diámetro del vaso que se dispone sobre el pico de la curva de porosidad.

15 8. El implante de la reivindicación 6, en donde el implante trenzado comprende, además, una meseta de porosidad que coincide con el rango radial de 1 mm en el diámetro del vaso que se dispone sobre el pico de la curva de porosidad.

9. El implante de la reivindicación 1, en donde una densidad de poro del implante trenzado es de aproximadamente 18 a 23 poros/mm².

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10. El implante de la reivindicación 1, en donde el implante trenzado es una estructura porosa sustancialmente cilíndrica.

11. El implante de la reivindicación 1, en donde el implante trenzado se forma a partir de una pluralidad de hebras individuales compuesta al menos de un primer material y de una o más hebras múltiples radiopacas.

5 12. El implante de la reivindicación 1, en donde el implante trenzado se forma a partir de una pluralidad de hebras múltiples formadas por monofilamentos cada uno colocado junto con monofilamentos, respectivamente.

10 13. Un sistema para tratar un aneurisma, que comprende:
una pluralidad de implantes trenzados, en donde cada implante trenzado comprende una porosidad sustancialmente consistente en un rango radial de 1 mm diferente en el diámetro del vaso, cada implante trenzado se configura para proporcionar una porosidad sustancialmente consistente en los rangos de diámetro radial de 1 mm diferentes.

15 14. El sistema de la reivindicación 13, en donde el implante trenzado se configura para usarse en un vaso estrechado, en donde el vaso estrechado comprende un diámetro de extremo proximal y un diámetro de extremo distal que difieren por hasta 1 mm, en donde el rango radial de 1 mm diferente en el diámetro del vaso se define comparando los extremos distal y proximal.

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15. El sistema de la reivindicación 13, en donde la pluralidad de implantes trenzados comprende:

un primer implante trenzado configurado para tratar un rango de diámetro de vaso de 2 a 3 mm;

un segundo implante trenzado configurado para tratar un rango de diámetro de vaso de 2,5 a 3,5 mm;

5 un tercer implante trenzado configurado para tratar un rango de diámetro de vaso de 3,0 a 4,0 mm;

un cuarto implante trenzado configurado para tratar un rango de diámetro de vaso de 3,5 a 4,5 mm;

10 un quinto implante trenzado configurado para tratar un rango de diámetro de vaso de 4,0 a 5,0 mm; y

un sexto implante trenzado configurado para tratar un rango de diámetro de vaso de 4,5 a 5,5 mm;

en donde la porosidad de cada implante trenzado varía entre 65 % y 70 %.

15 16. El sistema de la reivindicación 15, en donde cada implante trenzado comprende una densidad de poro que varía entre aproximadamente 18 a 23 poros/mm².

17. El sistema de la reivindicación 13, en donde cada una de la pluralidad de implantes trenzados se desvían entre sí por aproximadamente la mitad del rango radial
20 en el diámetro del vaso del siguiente implante trenzado más pequeño de la pluralidad de implantes trenzados.

18. Un método para tratar un aneurisma, el método comprende:

determinar un diámetro de vaso asociado con un vaso que tiene el aneurisma;

seleccionar uno de una pluralidad de implantes trenzados para tratar el vaso, en donde cada implante trenzado comprende una porosidad sustancialmente consistente hasta un rango de diámetro de vaso de 1 mm, cada implante trenzado se configura para proporcionar una porosidad sustancialmente consistente en los rangos de diámetro de vasos diferentes; y

tratar el recipiente con una de la pluralidad de implantes trenzados.

19. El método de la reivindicación 18, en donde el vaso está estrechado y el vaso estrechado comprende un diámetro de extremo distal y un diámetro de extremo proximal que difieren por hasta 1 mm, en donde determinar el diámetro del vaso comprende comparar los diámetros del extremo distal y proximal, el método comprende, además:

mantener la porosidad sustancialmente consistente a lo largo del vaso estrechado.

20. El método de la reivindicación 18, en donde el tratamiento del vaso comprende:

hacer avanzar el implante trenzado hacia un aneurisma; y

reconstituir el flujo de sangre en el vaso excluyendo el aneurisma y desviando el flujo sanguíneo desde el aneurisma usando uno de la pluralidad de implantes trenzados.



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August 07, 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: 16/056,135

FILING DATE: August 06, 2018

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US16/056,135

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



W. Montgomery
W. MONTGOMERY
Certifying Officer

Electronic Acknowledgement Receipt	
EFS ID:	33388260
Application Number:	16056135
International Application Number:	
Confirmation Number:	4845
Title of Invention:	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT
First Named Inventor/Applicant Name:	Robert SLAZAS
Customer Number:	6980
Filer:	Christopher Mark Franich/Tim Ellis
Filer Authorized By:	Christopher Mark Franich
Attorney Docket Number:	243382.000140
Receipt Date:	06-AUG-2018
Filing Date:	
Time Stamp:	17:57:57
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	080718INTEFSW00005410201507
Deposit Account	
Authorized User	

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	New-Application-Transmittal_AF_243382-000140.pdf	136168	no	2
			58c5be9ec16f9176d354f3e6bd9b69019f2704da		
Warnings:					
Information:					
2	Application Data Sheet	ADS_AF_243382-000140.pdf	87517	no	8
			fe3c48f17d094a0c5b2c9c760c75d4f9a8c2bdd6		
Warnings:					
Information:					
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3		Specification_AF_2018-08-06_PEZ171934_DSP6016_243382-000140.pdf	211037	yes	22
			994085abecab03678280165249f160638f02998f		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	18	
	Claims		19	21	
	Abstract		22	22	
Warnings:					
Information:					
4	Drawings-only black and white line drawings	Drawings_AF_243382-000140.pdf	1515996	no	8
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Warnings:					
Information:					

5	Oath or Declaration filed	Declaration_SLAZAS_AF_243382-000140pdf.pdf	1712928	no	2
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Warnings:					
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Information:					
6	Oath or Declaration filed	Declaration_PETERS_AF_243382-000140.pdf	3643038	no	2
			fa4fb13fc6c3d54efff598ba84b926f31a76da42a		
Warnings:					
Information:					
7	Information Disclosure Statement (IDS) Form (SB08)	SB08-Form_IDS_AF_243382-000140.pdf	1034351	no	4
			a461fc532cb9bca1eea559c41c9651cd2ad27a9f		
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Information:					
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8	Non Patent Literature	NPL_1_243382-000140.pdf	424581	no	5
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Warnings:					
Information:					
9	Miscellaneous Incoming Letter	Track-One-Prioritized-Exam-Request_AF_243382-000140.pdf	124654	no	2
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Warnings:					
Information:					
10	Power of Attorney	POA_AF_243382-000140.pdf	694167	no	2
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Warnings:					
Information:					

11	Fee Worksheet (SB06)	fee-info.pdf	35124	no	2
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Warnings:

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Total Files Size (in bytes):	9619561
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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

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UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))		<table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%;">Attorney Docket No.</td><td>243382.000140</td></tr><tr><td>First Named Inventor</td><td>SLAZAS, Robert</td></tr><tr><td>Title</td><td>SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT</td></tr><tr><td>Priority Mail Express® Label No.</td><td></td></tr></table>	Attorney Docket No.	243382.000140	First Named Inventor	SLAZAS, Robert	Title	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT	Priority Mail Express® Label No.																																													
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APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.		Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450																																																				
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*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																																																						
☒ The address associated with Customer Number: <u>06980</u> OR ☐ Correspondence address below																																																						
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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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The information provided by you in this form will be subject to the following routine uses:

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

SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT

Field

The present disclosure relates to implants within body vessels and more particularly to flow diverters, stents and related methods that included braided implants formed of strands of material.

Background

Vascular disorders and defects such as aneurysms and other arterio-venous malformations are especially difficult to treat when located near critical tissues or where ready access to a malformation is not available. Both difficulty factors apply especially to cranial aneurysms. Due to the sensitive brain tissue surrounding cranial blood vessels and the restricted access, it is very challenging and often risky to surgically treat defects of the cranial vasculature.

Typically, a stent-like vascular reconstruction device is first guided beneath the aneurysm to be treated using a delivery catheter. One commercially available reconstruction product is the CERENOVIOUS ENTERPRISE® Vascular Reconstruction Device and System as described, whereby The CERENOVIOUS ENTERPRISE® stent device is carried by a central delivery wire and initially held in place on the delivery wire in a collapsed state by a sheath-type introducer. Typically, a delivery catheter such as a PROWLER® SELECT® Plus microcatheter, also commercially available from Cerenovous and as disclosed by Gore et al. in U.S. Pat. No. 5,662,622, for example, is first positioned intravascularly with its distal tip slightly beyond the neck of the aneurysm. The tapered distal tip of the introducer is mated with the proximal hub of the delivery catheter, and the delivery wire is then advanced through the delivery catheter.

The CERENOVIOUS ENTERPRISE® stent device has a highly flexible, self-expanding closed cell design with a number of coils of radiopaque wire to serve as markers at each flared end of the device. Manufacture of such markers is relatively time-consuming and expensive due to the small size of the stent and the need to wrap the radiopaque wire multiple times around struts on the stent, which is especially difficult within closed cells of the stent.

Vascular aneurysms have several methods of treatment available. One approach includes flow diverting stents that can be intra-vascular stents dense enough so that blood flow is diverted from entering the aneurysm. Such flow diverters are a recent and growing treatment option. Otherwise, the majority of the current generation of flow diverters are composed of a tubular braid

of metal wires that operate similar to a finger trap toy. These tubular braids are then compressed radially, delivered through a small-bore catheter to the treatment site, and then expanded in place.

Further, the weakness and non-linear nature of the neurovasculature limits the applicability of such stents in procedures, for example, in repairing neurovascular defects. Furthermore, known delivery methods are less useful in vasoocclusive surgery, particularly when tiny vessels, such as those found in the brain, are to be treated. Accordingly, there is a need for braided implants that can be used with delivery techniques in vasoocclusive treatment of neurovascular defects that provides selective reinforcement in the vicinity of the neurovascular defect. There is also a need for a braided stent that reduces trauma or risk of rupture to the blood vessel. The solution of this disclosure resolves these and other issues of the art.

Summary

Disclosed herein are various exemplary devices, systems, and methods of the present disclosure that can address the above needs.

An object of the present solution is to provide one or more braided implants that are configured as flow diverters that provide longer vessel diameter ranges for tapering vessels and maintain the target porosity over a predetermined length (e.g., a 1 mm vessel diameter range).

An object of the present solution is to increase the applicable vessel diameter range for braided implants to minimize the number of devices necessary for practitioners when treating an aneurysm. In one example, the one or more braided implants comprise a broad plateau area of the characteristic porosity curve, indicating the braided implant(s) for vessel diameters within the plateau (resulting in a 1.0mm wide indicated range), and overlapping the device indicated ranges so the doctor has options for the best choice depending on the anatomy presented.

In certain examples, a braided implant is disclosed that is configured as a flow diverter for treating an aneurysm. The implant can include a braided mesh configured to maintain a substantially consistent target porosity in a tapered vessel over at least a 1mm vessel diameter range. The braided mesh can also be configured to maintain the substantially consistent target porosity between proximal and distal ends of the braided mesh while in the tapered vessel.

In certain examples, the tapered vessel includes a proximal end diameter and a distal end diameter that differ by up to 1mm, wherein the up to 1mm vessel diameter range is defined by

comparing the proximal and distal end diameters. However, it is contemplated that the diameter can differ by at least .5 mm or any other diameter differential as needed or required.

In certain examples, the substantially consistent target porosity is approximately 70%.

In certain examples, the predetermined length between proximal and distal ends of the braided mesh in the tapered vessel is at least 3 cm.

In certain examples, the predetermined length between proximal and distal ends of the braided mesh in the tapered vessel is at least 2 cm.

In certain examples, the predetermined length between proximal and distal ends of the braided mesh in the tapered vessel is at least 1 cm.

In certain examples, the predetermined length between proximal and distal ends of the braided mesh in the tapered vessel is defined between the proximal cavernous internal carotid artery and the internal carotid artery terminus.

In certain examples, a braided implant is disclosed for medical use. The implant can include a mesh having a proximal end and a distal end, wherein the mesh comprises a porosity substantially consistent between the proximal and distal ends over a 1 mm radial range in vessel diameter.

In certain examples, the porosity is approximately 70% over the 1 mm radial range in vessel diameter.

In certain examples, the braided implant further comprises an indicated vessel diameter, and wherein the braided implant is configured such that the indicated vessel diameter coincides with a peak of a porosity curve of the braided implant. The braided implant can include a porosity plateau that corresponds to the 1mm radial range in vessel diameter that is disposed about the peak of the porosity curve.

In certain examples, across a vessel diameter range of 2 to 3 mm, a porosity of the braided implant ranges between 65% and 70%.

In certain examples, across a vessel diameter range of 2.5 to 3.5 mm, a porosity of the braided implant ranges between 65% and 70%.

In certain examples, across a vessel diameter range of 3.0 to 4.0 mm, a porosity of the braided implant ranges between 65% and 70%.

In certain examples, across a vessel diameter range of 3.5 to 4.5 mm, a porosity of the braided implant ranges between 65% and 70%.

In certain examples, across the braided implant is configured for a vessel diameter range of 3.5 to 4.5 mm, and wherein the braided implant includes a porosity of 69% at a vessel diameter of 3.5mm; a porosity of 69% at a vessel diameter of 4.0 mm; and a porosity of 67% at a vessel diameter of 4.5 mm.

In certain examples, across a vessel diameter range of 4.5 to 5.5 mm, a porosity of the braided implant ranges between 65% and 70%.

In certain examples, a pore density of the braided implant is 18 pores / mm².

In certain examples, a pore density of the braided implant is 23 pores / mm².

In certain examples, a pore density of the braided implant is 19 pores / mm².

In certain examples, a pore density of the braided implant is approximately 18 to 23 pores / mm².

In certain examples, a target vessel treated by the braided implant is tapered.

In certain examples, the braided implant is a substantially cylindrical porous structure.

In certain examples, the braided implant is a stent.

In certain examples, the braided implant is a flow diverter.

In certain examples, the braided implant is formed from a plurality of single strands composed of at least a first material and one or more radiopaque multi-strands.

In certain examples, the braided implant is woven to include at least a second multi-strand.

In certain examples, the braided implant is formed from a plurality of multi-formed of monofilaments each laid together with monofilaments, respectively.

In certain examples, the braided implant further includes a pattern of that is woven, wherein the pattern comprises openings defined by a plurality of single strands oriented in a first direction and by a plurality of single strands oriented in a second direction transverse to the first direction.

In certain examples, the braided implant further includes a pattern of that is braided, wherein the pattern comprises openings defined by a plurality of single strands oriented in a first direction and by a plurality of single strands oriented in a second direction transverse to the first direction.

In certain examples, a system for treating an aneurysm is disclosed. The system can include a plurality of braided implants, wherein each braided implant comprises a porosity substantially consistent over a different 1 mm radial range in vessel diameter, each braided implant configured to provide substantially consistent porosity over different 1 mm diameter ranges.

In certain examples, the braided implant is configured for use in a tapered vessel. The tapered vessel can include a proximal end diameter and a distal end diameter that differ by up to 1mm. The different 1 mm radial range in vessel diameter can be defined by comparing the proximal and distal end diameters. However, the different 1 mm radial range in vessel diameter can be also determined by measuring the vessel diameter at two separate locations at the treatment site.

In certain examples, the plurality of braided implants of the system is configured to treat any vessel within a 1.5 mm to 6 mm diameter range.

In certain examples, the plurality of braided implants of the system includes a first braided implant (10) configured to treat a vessel diameter range of 2 to 3 mm; a second braided implant (10) configured to treat a vessel diameter range of 2.5 to 3.5 mm; a third braided implant (10) configured to treat a vessel diameter range of 3.0 to 4.0 mm; a fourth braided implant (10) configured to treat a vessel diameter range of 3.5 to 4.5 mm; a fifth braided implant (10) configured to treat a vessel diameter range of 4.0 to 5.0 mm; and a sixth braided implant (10) configured to treat a vessel diameter range of 4.5 to 5.5 mm. The porosity of each braided implant (10) can range between 65% and 70% at the indicated vessel range for the respective implant. In some examples, the porosity of each braided implant is approximately 70%. In some examples, each braided implant further comprises an indicated vessel diameter, and wherein the braided implant is configured such that the indicated vessel diameter coincides with a peak of a porosity curve of the braided implant. In some examples, each braided implant further includes a porosity plateau that corresponds to the 1mm range in vessel diameter that is disposed about the peak of the porosity curve. In some examples, each braided implant includes a pore density ranging approximately between 18 to 23 pores / mm².

In some examples, a pore density of the first braided implant is 18 pores / mm².

In some examples, a pore density of the second braided implant is 23 pores / mm².

In some examples, a pore density of the third braided implant is 18 pores / mm².

In some examples, a pore density of the fourth braided implant is 19 pores / mm².

In some examples, a pore density of the fifth braided implant is 23 pores / mm².

In some examples, a pore density of the sixth braided implant is 21 pores / mm². In some examples, the braided implant includes radiopaque materials such as platinum, chromium, cobalt, tantalum, tungsten, gold, silver, and alloys thereof.

In some examples, a system for treating an aneurysm is disclosed. The system can include a plurality of braided implants, wherein each braided implant a porosity substantially consistent over a different .5 mm radial range in vessel diameter, each braided implant (10) configured to provide substantially consistent porosity over different .5 mm radial diameter ranges. However, other different radial ranges could be used as needed or required with the system, including different vessel diameter ranges of .3 mm, .4 mm, .6 mm, .7 mm, .8 mm, .9 mm, or the like.

In some examples, a method is disclosed for treating an aneurysm. The method can include determining a vessel diameter associated with a vessel of the aneurysm; selecting one of a plurality of braided implants for treating the vessel (e.g., based on the determined vessel diameter), wherein each braided implant includes a porosity substantially consistent over at least a 1 mm vessel diameter range, each braided implant configured to provide substantially consistent porosity over different 1 mm diameter ranges; and treating the vessel with the one of the plurality of braided implants.

In some examples, the vessel is tapered and includes a proximal end diameter and a distal end diameter that differ by up to 1mm, wherein the determining the vessel diameter includes comparing the proximal and distal end diameters or diameters.

In some examples, the vessel is tapered and has approximately 1 mm vessel diameter differential, the method further includes maintaining the substantially consistent porosity across the approximately 1 mm vessel diameter differential.

In some examples, the method includes configuring each braided implant to cover a vessel diameter range with 0.5mm overlap between each respective other braided implant.

In some examples, the vessel diameter is tapered and ranges between approximately 3-4 mm.

In some examples, the vessel diameter is tapered and ranges between approximately 3.5-4.5 mm.

In some examples, the vessel diameter is tapered and ranges between approximately 4-5 mm.

In some examples, the vessel diameter is tapered and ranges between approximately 4.5-5.5 mm.

In some examples, the vessel diameter is tapered and ranges between approximately 5.0-6.0 mm.

In some examples, the vessel diameter is tapered and the plurality of braided implants is configured to treat vessel diameters ranging between 1.5 - 6 mm.

In some examples, the determining a vessel diameter is implemented by X-ray, fluoroscopy, MRI, or other visualization means

In some examples, the treating the vessel includes advancing the braided implant to an aneurysm; and reconstructing blood flow in the vessel by excluding the aneurysm and diverting blood flow from the aneurysm using the one of the plurality of braided implants.

To the accomplishment of the foregoing and related ends, certain illustrative aspects are described herein in connection with the following description and the appended drawings. These aspects are indicative, however, of but a few of the various ways in which the principles of the claimed subject matter may be employed and the claimed subject matter is intended to include all such aspects and their equivalents. Other advantages and novel features may become apparent from the following detailed description when considered in conjunction with the drawings.

Brief Description of the Drawings

The above and further aspects of this solution are further discussed with reference to the following description in conjunction with the accompanying drawings, in which like numerals indicate like structural elements and features in various figures. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the invention. The figures depict one or more implementations of the inventive devices, by way of example only, not by way of limitation.

Fig. 1 is a schematic enlarged view of a portion of an implant body formed of single strands and one or more radiopaque multi-strands according to the present invention;

Fig. 2 depicts a side plan view of an example vessel contemplated for use with the braided implant of this disclosure;

Fig. 3 is a graph that shows porosity versus vessel diameter for an example braided implant of this disclosure;

Fig. 4 is a graph that compares the porosity versus vessel diameter for an example braided implant of this disclosure versus a conventional device;

Fig. 5 is a graph that shows the pore density and number of wires versus vessel diameter for a set of example braided implants of this disclosure;

Fig. 6 is a graph that compares the porosity versus vessel diameter for a set of example braided implants of this disclosure versus a set of conventional devices;

Fig. 7 depicts a flow diagram outlining example method steps of this disclosure; and

Fig. 8 depicts a flow diagram outlining example method steps of this disclosure.

Detailed Description

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.

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.

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.

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.

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.

As discussed herein, “strand” is intended in its broadest meaning to include a wire, a fiber, a filament, or other single elongated member.

As discussed herein, “radiopaque” is utilized for its normal meaning of being radiodense, that is, formed of one or more materials which inhibit the passage of electromagnetic radiation to increase visibility during imaging. Suitable radiopaque materials for use according to the present invention include platinum, chromium, cobalt, tantalum, tungsten, gold, silver, and alloys thereof.

The braided implants 10 of this disclosure can be better understood when looking at the figures appended to this disclosure. For instance, in Fig. 1, a schematic enlarged view of a portion of a braided implant 10 is shown according to an example of this disclosure. Braided implant 10 can be formed of single strands 12 composed of at least a first material and one or more radiopaque multi-strands 14. In this construction, implant 10 is woven to include at least a second multi-strand 16. In another construction, indicated by dashed lines, the implant 10 further includes multi-strands 18 and 20 formed of monofilaments 22 and 24 each laid together with monofilaments 26 and 28, respectively. The pattern of implant 10, which is woven in some constructions and braided in other constructions, includes openings 30 defined by single strands 12 oriented in a first direction and by single strands 24 and 25 oriented in a second direction that is transverse to the first direction, for example. Implant 10 further includes openings 32 and 34 defined on either side of multi-strand 14 by single strands 13 and 15 oriented in the same direction as multi-strand 14 and by single strands 24, 25 and 27 oriented in a transverse direction. In some constructions, openings 32 and 34 are slightly larger than openings 30 which are defined only by single strands; in other constructions, all openings 30, 32 and 34 are substantially the same.

Other embodiments are contemplated for implants 10 of this disclosure and can also be observed in U.S. Pat. Pub. 2016/0058524, a reference that is incorporated in its entirety herein. Braided implant 10 constructions of this disclosure in some examples are considered to have substantially the same pattern as if implant 10 were formed solely from single strands of material. Since the multi-strands are braided, woven or otherwise laid in parallel to each other in the same manner as if single strands of radiopaque material were utilized, and especially when each filament

of the multi-strand has the same diameter as the single strands, there is little or no mechanical impact to the performance of the implant, such as flexibility, ability to expand, and crimped profile.

Turning to Fig. 2, a side plan view of an example vessel is shown that is contemplated for use with implant 10 of this disclosure. As can be seen, the example vessel tapers along its longitudinal axis of the internal carotid artery (ICA). *See*, Rai AT, Hogg JP, Cline B, et al. J NeuroIntervent Surg (2012) which is incorporated by reference in its entirety. The Rai study undertook to determine the typical length, diameter and taper of vessels in the anterior cerebral circulation. The arterial diameter was measured at the proximal cavernous ICA, the ICA terminus, the middle cerebral artery MCA origin and an M2 origin. The length between these endpoints was calculated along the center line. The vessel taper was calculated for the ICA as the change in caliber per unit length. In carrying out this study, the Rai study determined that the mean diameter at the cavernous ICA and the ICA terminus was 5 ± 0.6 mm and 3.6 ± 0.4 mm, respectively. The mean ICA taper was 0.04 ± 0.02 mm/1 mm. For the MCA, the diameter at the MCA and M2 origins measured 3.1 ± 0.4 mm and 2.4 ± 0.4 mm, respectively.

Fig. 2 provides non-limiting examples of diameter measurements at respective lengths taken from the proximal cavernous ICA towards the ICA terminus further exemplifying the tapering nature of the vessel. The Rai study confirmed that the ICA tapers from its proximal cavernous segment to the ICA terminus that implant 10 is configured to treat.

Turning to Fig. 3, a graph is provided that shows the percent porosity of an example braided implant 10 of this disclosure as compared to vessel diameter that were investigated for this disclosure. As can be seen, the braided implant 10 of this disclosure held a relatively consistent pore size and porosity over a 1 mm vessel diameter range. Throughout this disclosure, when referring to a vessel diameter range, it is intended that this term means a range of diameters as measured between two separate locations in the vessel being treated by braided implant 10. For example, a practitioner using X-ray visualization could measure the vessel diameter of the proximal cavernous ICA as 4.2 mm whereas the vessel diameter towards the ICA terminus could be 3.2. In this respect, the vessel diameter range in this example tapered vessel would be 1mm. The implants 10 of this disclosure are designed to accommodate such tapering vessels across these example vessel diameter ranges while also maintaining a substantially consistent target porosity. This is particularly advantageous since it means fewer implants are required to accommodate

vessels that tapering greater than conventional devices (e.g., vessel diameter ranges of approximately .25 mm) or tortuosity typically seen in the neurovasculature.

With this, Fig. 3 depicts an example vessel having a 1mm vessel diameter range between 3.5 mm to 4.5 mm. In this example, the braided implant 10 of this disclosure maintained approximately 70% porosity. Specifically, at a diameter of 3.5 mm, the porosity of the braid was approximately 69%. At a diameter of 4.0 mm, the porosity of the braid was approximately 69%. At a diameter of 4.5 mm, the porosity of the braid was approximately 67%.

Turning to Fig. 4, a graph is provided that summarizes a comparison carried out whereby the porosity versus vessel diameter is shown for an example implant 10 of this disclosure versus the Pipeline™ Embolization Device (PED) by Medtronic across a 1mm vessel diameter range. Specifically, braided implant 10 and the PED device were compared between a vessel diameter range of 3.5 mm to 4.5 mm. As can be seen, the braided implant 10 of this disclosure held a relatively consistent pore size and porosity over a 1 mm vessel diameter range at about 70% across the same range previously shown in Fig. 3. Conversely, the PED device at 3.5 mm vessel diameter demonstrated 80% porosity, at 4mm vessel diameter demonstrated a 70% porosity, and at 4.5 mm vessel diameter demonstrated less than 50% porosity. Stated differently, the porosity of the PED device diminished appreciably as the diameter of the vessel increased across the 1mm range, whereas the example braided implant 10 of this disclosure demonstrated a substantially consistent porosity over the 1mm diameter range.

Fig. 4 also shows the porosity of each device as it changes while expanding and it is characteristically the same. In certain examples, the braided implant 10 is designed such that the indicated vessel diameter coincides with the peak of the porosity curve and the plateau area around it (which deviates from the target porosity very little). For example, in Fig. 3 the braided implant 10 shown is indicated for an artery diameter range from 3.5mm to 4.5mm. This device remains very close to the target porosity of 70% throughout its expansion range, which has a width of 1.0mm.

When the device is compressed, for example, it is dense so its porosity is very low (see, e.g., the lower-left of Fig. 3). As the device expands, the porosity increases since the pores of the braided implant 10 are opening. At a certain point, the porosity reaches a peak, which is when the braiding angle is at 90 degrees since each pore can be a square, and as large as it can get, shown at the center arrow of Fig. 3. Further expansion of the diameter past this peak then reduces the size

of each pore and thus the porosity. When the braided implant 10 reaches maximum diameter at its expansion limit, then braided implant 10 is again very dense and porosity is correspondingly low (see, e.g., lower-right of Fig. 3).

In contrast, other devices known might be designed differently, so that the plateau area of the porosity curve is not as wide as 1.0 mm, or they might be indicated for artery diameters that do not coincide with the plateau area. In these older approaches, the range of diameters that coincide with the target porosity would be narrow since outside the plateau, small changes in artery diameter result in large deviations from the target porosity. Accordingly, other devices known would be incapable of being able to treat a wider range of vessel diameters.

Turning to Fig. 5, a graph is provided that summarizes the porosity versus vessel diameter for an example braided implant 10 of this disclosure. Specifically, Fig. 5 shows six separate braided implants (10) that each have approximately a 1 mm range in vessel diameter, and offset from one another by approximately half of that range (0.5mm). The legend shows the range of vessel diameters from minimum to maximum and corresponding label for the applicable braided implant (10). For example, a first braided implant (10) is configured for a vessel diameter range between 2.0 mm and 3.0 mm with a label of 2.5 mm. The first braided implant (10) has 48 wires with a pore density (mm^2) of 18. A second braided implant (10) is configured for a vessel diameter range between 2.5 mm and 3.5 mm with a label of 3 mm. The second braided implant (10) has 64 wires with a pore density (mm^2) of 23. A third braided implant (10) is configured for a vessel diameter range between 3.0 mm and 4.0 mm with a label of 3.5 mm. The third braided implant (10) has 64 wires with a pore density (mm^2) of 18. A fourth braided implant (10) is configured for a vessel diameter range between 3.5 mm and 4.5 mm with a label of 4.0 mm. The fourth braided implant (10) has 72 wires with a pore density (mm^2) of 19. A fifth braided implant (10) is configured for a vessel diameter range between 4.0 mm and 5.0 mm with a label of 4.5 mm. The fifth braided implant (10) has 96 wires with a pore density (mm^2) of 21. A sixth braided implant (10) is configured for a vessel diameter range between 4.5 mm and 5.5 mm with a label of 5 mm. The sixth braided implant (10) has 96 wires with a pore density (mm^2) of 21.

Turning to Fig. 6, a graph is provided that summarizes a comparison carried out whereby the porosity versus vessel diameter is shown for set of example implants (10) of this disclosure versus a set of PED devices across different vessel diameter ranges, including from 2mm to 6mm. Specifically, in the first braided implant 10 indicated as being configured for use across a vessel

diameter of 2 mm to 3 mm, braided implant 10 was observed as providing approximately 70% porosity, whereas a comparable PED device was only able to maintain approximately 70% porosity across a vessel diameter of 2.5 mm to 2.75 mm (i.e. only a .25 mm vessel diameter range). Another PED device in the relevant diameter range was necessary for said PED device just to complete the gap from 2.75 mm to 3.0 mm vessel diameter range, as shown. The first braided implant (10) was constructed from 48 strands of wire and the PED device was similarly constructed from 48 strands of wire. For the 2.0 mm to 2.5 mm range, two more PED devices would also be required, since the PED device only demonstrated a 0.25 mm range capable of maintaining 70% porosity during use.

Fig. 6 also depicts that a second braided implant (10) indicated as being configured for use across a vessel diameter of 2.5 mm to 3.5 mm, braided implant (10) was observed as providing approximately 70% porosity, whereas a comparable PED device was only able to maintain approximately 70% porosity across a vessel diameter of 3.0 mm to 3.25 mm (i.e. only a .25 mm vessel diameter range). The second braided implant (10) in this example was constructed from 64 strands of wire while the PED device was constructed from 48 strands of wire. In other words, at a vessel diameter of 3 mm, the second braided implant (10) used approximately 21.3 strands / mm of vessel diameter while the PED device used 16 strands / mm of vessel diameter. As a result of using fewer strands per diameter, the PED device has a porosity vs diameter curve that has a narrower plateau section than the second braided implant (10). Further, another PED device in the relevant diameter range was necessary for said PED device just to complete the gap from 3.25 mm to 3.50 mm vessel diameter range, as shown. Further, as shown with respect to the 2.5 mm to 3.0 mm range and the first braided implant (10), two more PED devices would also be required, since the PED device only demonstrated a .25mm range capable of maintaining 70% porosity during use.

Fig. 6 also depicts that a third braided implant (10) indicated as being configured for use across a vessel diameter of 3.0 mm to 4.0 mm, braided implant (10) was observed as providing approximately 70% porosity, whereas a comparable PED device was only able to maintain approximately 70% porosity across a vessel diameter of 3.5 mm to 3.75 mm (i.e. only a .25 mm vessel diameter range). The third braided implant (10) in this example was constructed from 64 strands of wire while the PED device was constructed from 48 strands of wire. In other words, at a vessel diameter of 3.5 mm, the third braided implant (10) used approximately 18.3 strands / mm

of vessel diameter while the PED device used 13.7 strands / mm of vessel diameter. As a result of using fewer strands per diameter, the PED device has a porosity vs diameter curve that has a narrower plateau section than the third braided implant (10). Further, another PED device in the relevant diameter range was necessary for said PED device just to complete the gap from 3.75 mm to 4.00 mm vessel diameter range, as shown.

Fig. 6 also depicts that a fourth braided implant (10) indicated as being configured for use across a vessel diameter of 3.5 mm to 4.5 mm, braided implant (10) was observed as providing approximately 70% porosity, whereas a comparable PED device was only able to maintain approximately 70% porosity across a vessel diameter of 4.0 mm to 4.25 mm (i.e. only a .25 mm vessel diameter range). The fourth braided implant (10) in this example was constructed from 72 strands of wire while the PED device was constructed from 48 strands of wire. In other words, at a vessel diameter of 4 mm, the fourth braided implant (10) used approximately 18 strands / mm of vessel diameter while the PED device used 12 strands / mm of vessel diameter. As a result of using fewer strands per diameter, the PED device has a porosity vs diameter curve that has a narrower plateau section than the fourth braided implant (10). Further, another PED device in the relevant diameter range was necessary for said PED device just to complete the gap from 4.25 mm to 4.50 mm vessel diameter range, as shown.

Fig. 6 also depicts that a fifth braided implant (10) indicated as being configured for use across a vessel diameter of 4.0 mm to 5.0 mm, braided implant (10) was observed as providing approximately 70% porosity, whereas a comparable PED device was only able to maintain approximately 70% porosity across a vessel diameter of 4.5 mm to 4.75 mm (i.e. only a .25 mm vessel diameter range). The fifth braided implant (10) in this example was constructed from 96 strands of wire while the PED device was constructed from 48 strands of wire. In other words, at a vessel diameter of 4.5 mm, the fifth braided implant (10) used approximately 21.3 strands / mm of vessel diameter while the PED device used 10.7 strands / mm of vessel diameter. As a result of using fewer strands per diameter, the PED device has a porosity vs diameter curve that has a narrower plateau section than the fifth braided implant (10). Further, another PED device in the relevant diameter range was necessary for said PED device just to complete the gap from 4.75 mm to 5.00 mm vessel diameter range, as shown.

Fig. 6 also depicts that a sixth braided implant (10) indicated as being configured for use across a vessel diameter of 4.5 mm to 5.5 mm, braided implant (10) was observed as providing

approximately 70% porosity, whereas a comparable PED device was only able to maintain approximately 70% porosity across a vessel diameter of 5.0 mm to 5.25 mm (i.e. only a .25 mm vessel diameter range). The sixth braided implant (10) in this example was constructed from 96 strands of wire while the PED device was constructed from 48 strands of wire. In other words, at a vessel diameter of 5.0 mm, the sixth braided implant (10) used approximately 19.2 strands / mm of vessel diameter while the PED device used 9.6 strands / mm of vessel diameter. As a result of using fewer strands per diameter, the PED device has a porosity vs diameter curve that has a narrower plateau section than the sixth braided implant (10). Further, another PED device in the relevant diameter range was necessary for said PED device just to complete the gap from 5.25 mm to 5.50 mm vessel diameter range, as shown.

As seen in Fig. 6, for each indicated 1mm vessel range covered by one of braided implants (10), four separate PED devices would be required by the practitioner for similar coverage in corresponding vessels, which is both inconvenient, wasteful, but quite possibly unsafe given the nature of blood vessels afflicted with hemorrhagic events and tendencies to taper considerably. For example, if a vessel were to taper more than .25 mm, then no current PED device would adequately treat the afflicted vessel in a manner that maintains a substantially consistent target porosity of 70%.

In Fig. 7, a flow diagram depicts one example method 700 and corresponding steps. Step 710 includes determining a vessel diameter associated with a vessel having the aneurysm. Step 720 includes selecting one of a plurality of braided implants (10) for treating the vessel, wherein each braided implant (10) comprises a porosity substantially consistent over up to a 1 mm vessel diameter range, each braided implant (10) configured to provide substantially consistent porosity over different 1 mm diameter ranges. Step 730 includes treating the vessel with the one of the plurality of braided implants (10).

In Fig. 8, a flow diagram depicts one example method 800 and corresponding steps. Step 810 includes determining a vessel diameter associated with a vessel containing the aneurysm. Step 820 includes selecting one of a plurality of braided implants (10) for treating the vessel, wherein each braided implant (10) comprises a porosity substantially consistent over at least a 0.5 mm vessel diameter range, each braided implant (10) configured to provide substantially consistent porosity over different 0.5 mm diameter ranges. Step 830 includes treating the vessel with the one of the plurality of braided implants (10).

The braided implants (10) of this disclosure are particularly advantageous since a doctor can benefit from a wider indicated diameter range since it can afford some forgiveness for measurement inaccuracies and/or errors (e.g. an artery is measured on X-ray or any other visualization means to be 3.3mm when it is actually 3.5mm). Doctors can also benefit since a wider indicate diameter range can maintain consistent porosity close to the target porosity in tapering vessels, which is common. The implant (10) of this disclosure is also advantageous since the anatomical range of artery diameters can be treated with fewer devices, simplifying the device selection process and saving storage space for the inventory they must keep on hand.

In certain examples, a set or family of implants (10) is disclosed, each with a 1.0mm wide indicated diameter range, are arranged such that they cover the anatomical range with 0.5mm overlap, as shown in Figs. 5-6. It is noted that the ranges depicted and described throughout reference a vessel diameter range of up to 1 mm for a respective braided implant (10). However, it is contemplated that the braided implant (10) can be adapted for more than a 1mm vessel diameter range. The braided implants (10) of this disclosure are s particularly advantageous since for any given artery diameter, there exists two different options of a device that can be selected. For example, an artery with a diameter of 3.25 mm can be at a desired treatment location in the vasculature. If the artery tapers down as you move away from the treatment location (i.e. becomes smaller), then the doctor could select the smaller implant from the set or family of implants by, for example, selecting an implant listed at 2.5 mm, rather than 3.5 mm. In this respect, the artery segment is exposed to target porosity over a longer length. Conversely, if the artery tapers up as you move away from the treatment location (i.e. becomes larger), then the doctor could select the larger implant from the set or family by, for example, selecting an implant listed at 3.0 mm to 4.0 mm. In this respect, similar to the previous example, the artery segment is exposed to the target porosity over a longer length.

The advantages in the present disclosure result from providing a braided implant with a broad plateau area of the characteristic porosity curve so that implant or the family or set of implants is capable of treating artery diameters within the plateau of an approximate 1.0mm wide indicated range, and overlapping the indicated diameter ranges so the doctor has options for the best choice depending on the anatomy presented.

In certain examples, each of the side-by-side filaments of the braided implants of this disclosure include a monofilament of radiopaque material. In one construction, the carrier having

the multi-strand is substantially the same as the carriers for the single strands. Each of the side-by-side filaments of the multi-strand is a monofilament of radiopaque material. Preferably, the diameter of each side-by-side filament is substantially the same as the diameter of the single strands. Forming the body includes establishing a first spacing pattern, such as an open braid pattern or an open weave pattern, and a first wall thickness, and each multi-strand joins in the first spacing pattern without substantial deviation from that pattern and without substantially altering the first wall thickness.

In certain techniques, at least one multi-strand carrier is utilized for every dozen single-strand carriers. Some machines have at least 42 carriers, such as 48 carriers, and at least 6 of the carriers, such as 8 carriers, are loaded with the multi-strands of radiopaque material. This still results in a 48-carrier braid but having double the number of radiopaque strands as when the 8 carriers are loaded with single strands of radiopaque material.

Braided implants of this disclosure, including flow diverters, can be designed for a specific percentage of coverage area per artery area or inversely, the percentage of open area remaining per artery area, known in this disclosure as "porosity", after they have been delivered and expanded in place at the treatment site. The designed porosity can be adjusted by the braiding parameters, such as number of wires, width of wires, braided diameter, and braiding angle which can be alternatively measured as PPI or pitch. Once the target porosity is identified based on these factors, the braid design can be adjusted so that it reaches the target porosity when expanded to the indicated artery diameter.

Braided implants of this disclosure, including flow diverters, can have many variants within a set or family that reach the target porosity at different artery diameters. Therefore, the set or family of devices together allow the physician to treat any diameter artery within the anatomical range (1.5mm to 6mm is typical for neurovascular).

The descriptions contained herein are examples illustrating the various embodiments and are not intended to limit the scope of the disclosure. As described herein, the invention contemplates many variations and modifications of a system, device, or method that can be used. Variations can include but are not limited to alternative geometries of elements and components described herein, utilizing any of numerous materials for each component or element (e.g. radiopaque materials, memory shape metals, etc.). These modifications would be apparent to those

having ordinary skill in the art to which this invention relates and are intended to be within the scope of the claims which follow.

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 braided implant configured as a flow diverter for treating an aneurysm, the implant comprising:

a braided mesh configured to maintain a substantially consistent target porosity in a tapered vessel up to a 1mm vessel diameter range;

wherein the braided mesh is configured to maintain the substantially consistent target porosity between proximal and distal ends of the braided mesh while in the tapered vessel.

2. The implant of Claim 1, wherein the tapered vessel comprises a proximal end diameter and a distal end diameter that differ by up to 1 mm, wherein the up to 1 mm vessel diameter range is defined by comparing the proximal and distal end diameters.

3. The implant of Claim 1, wherein the substantially consistent target porosity is approximately 70%.

4. The implant of Claim 1, wherein a predetermined length between proximal and distal ends of the braided mesh in the tapered vessel is at least 3 cm.

5. The implant of Claim 1, wherein a predetermined length between proximal and distal ends of the braided mesh in the tapered vessel is at least 1 cm.

6. The implant of Claim 1, wherein the braided implant further comprises an indicated vessel diameter, and wherein the braided implant is configured such that the indicated vessel diameter coincides with a peak of a porosity curve of the braided implant.

7. The implant of Claim 6, wherein the braided implant further comprises a porosity plateau that corresponds to the 1mm radial range in vessel diameter that is disposed about the peak of the porosity curve.

8. The implant of Claim 6, wherein the braided implant further comprises a porosity plateau that coincides with the 1mm radial range in vessel diameter that is disposed about the peak of the porosity curve.

9. The implant of claim 1, wherein a pore density of the braided implant is approximately 18 to 23 pores / mm².

10. The implant of claim 1, wherein the braided implant is a substantially cylindrical porous structure.

11. The implant of Claim 1, wherein the braided implant is formed from a plurality of single strands composed of at least a first material and one or more radiopaque multi-strands.

12. The implant of Claim 1, wherein the braided implant is formed from a plurality of multi-strands formed of monofilaments each laid together with monofilaments, respectively.

13. A system for treating an aneurysm, comprising:

a plurality of braided implants, wherein each braided implant comprises a porosity substantially consistent over a different 1 mm radial range in vessel diameter, each braided implant configured to provide substantially consistent porosity over different 1 mm radial diameter ranges.

14. The system of Claim 13, wherein the braided implant is configured for use in a tapered vessel, wherein the tapered vessel comprises a proximal end diameter and a distal end diameter that differ by up to 1mm, wherein the different 1 mm radial range in vessel diameter is defined by comparing the proximal and distal end diameters.

15. The system of Claim 13, wherein the plurality of braided implants comprises:
a first braided implant configured to treat a vessel diameter range of 2 to 3 mm;
a second braided implant configured to treat a vessel diameter range of 2.5 to 3.5 mm;
a third braided implant configured to treat a vessel diameter range of 3.0 to 4.0 mm;
a fourth braided implant configured to treat a vessel diameter range of 3.5 to 4.5 mm;

a fifth braided implant configured to treat a vessel diameter range of 4.0 to 5.0 mm; and
a sixth braided implant configured to treat a vessel diameter range of 4.5 to 5.5 mm;
wherein the porosity of each braided implant ranges between 65% and 70%.

16. The system of Claim 15, wherein each braided implant comprises a pore density ranging between approximately 18 to 23 pores / mm².

17. The system of Claim 13, wherein each of the plurality of braided implants are offset from one another by approximately half of the radial range in vessel diameter of the next smallest braided implant of the plurality of braided implants.

18. A method of treating an aneurysm, the method comprising:
determining a vessel diameter associated with a vessel having the aneurysm;
selecting one of a plurality of braided implants for treating the vessel, wherein each braided implant comprises a porosity substantially consistent over up to a 1 mm vessel diameter range, each braided implant configured to provide substantially consistent porosity over different vessel diameter ranges; and
treating the vessel with the one of the plurality of braided implants.

19. The method of Claim 18, wherein the vessel is tapered and the tapered vessel comprises a proximal diameter and a distal diameter that differ by up to 1mm, wherein the determining the vessel diameter comprises comparing the proximal and distal end diameters, the method further comprising:
maintaining the substantially consistent porosity across the tapered vessel.

20. The method of Claim 18, wherein the treating the vessel comprises:
advancing the braided implant to an aneurysm; and
reconstructing blood flow in the vessel by excluding the aneurysm and diverting blood flow from the aneurysm using the one of the plurality of braided implants.

Abstract

A braided implant configured as a flow diverter for treating an aneurysm. The implant can include a braided mesh configured to maintain a substantially consistent target porosity over up to a 1 mm vessel diameter range over a predetermined length in a tapered vessel.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

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Application Number	Herewith
Filing Date	08/06/2018
First Named Inventor	Robert SLAZAS
Title	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	243382.000140

SIGNATURE of Applicant or Patent Practitioner			
Signature	/Louis J. DelJuidice - 47,522/	Date (Optional)	08/06/2018
Name	Louis J. DelJuidice	Registration Number	47522
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.			
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I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

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I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

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Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
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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).

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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**SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT**

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 _____

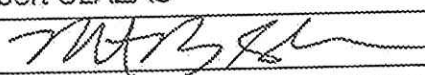
filed on _____

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 INVENTORInventor: Robert SLAZASDate (Optional): 06 AUG 2018Signature: 

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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

SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT

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.

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LEGAL NAME OF INVENTOR

Inventor: Geoff PETERS

Date (Optional): 8/6/2018

Signature:

Geoff Peters

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.

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

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Fig. 1

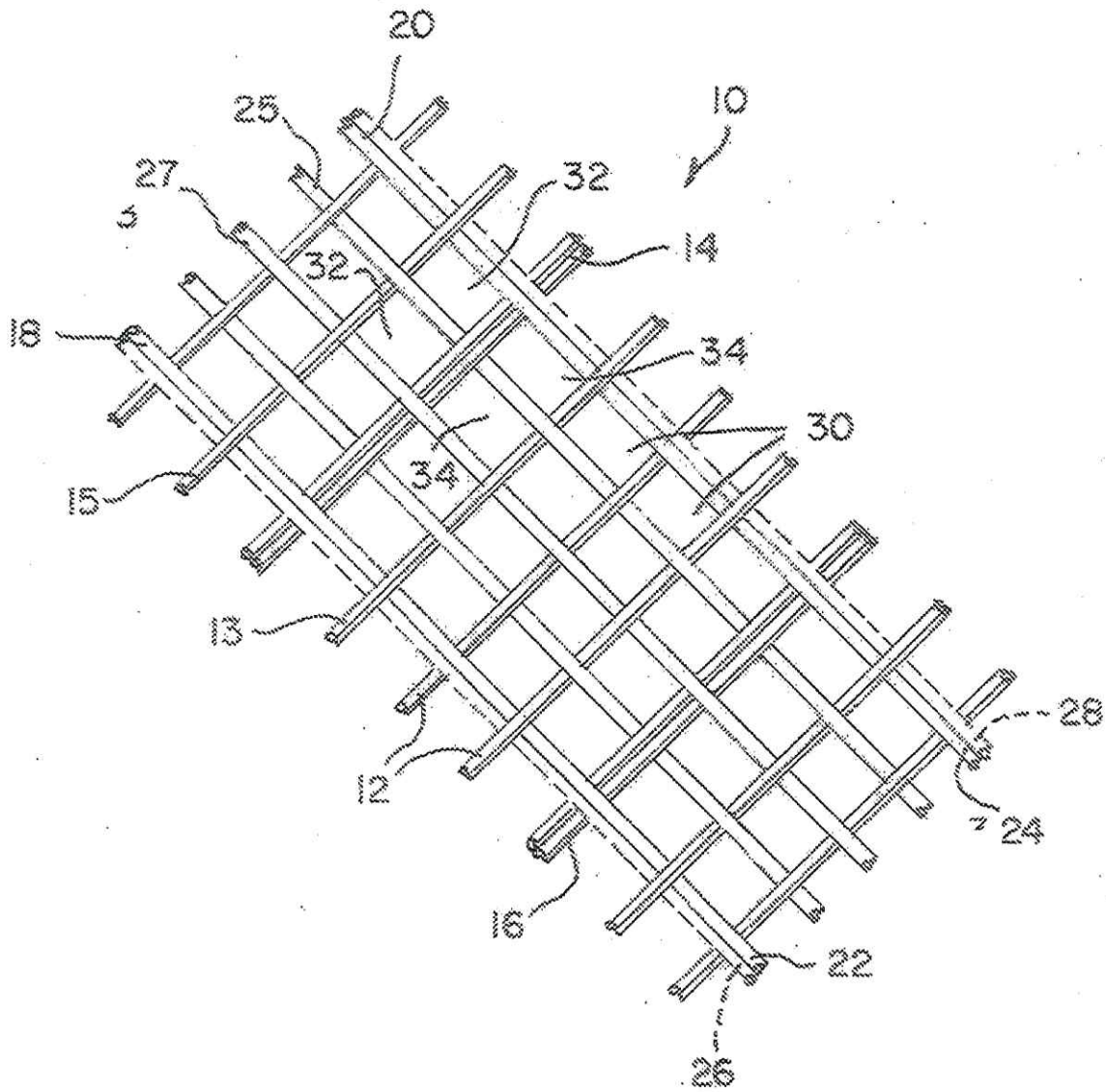
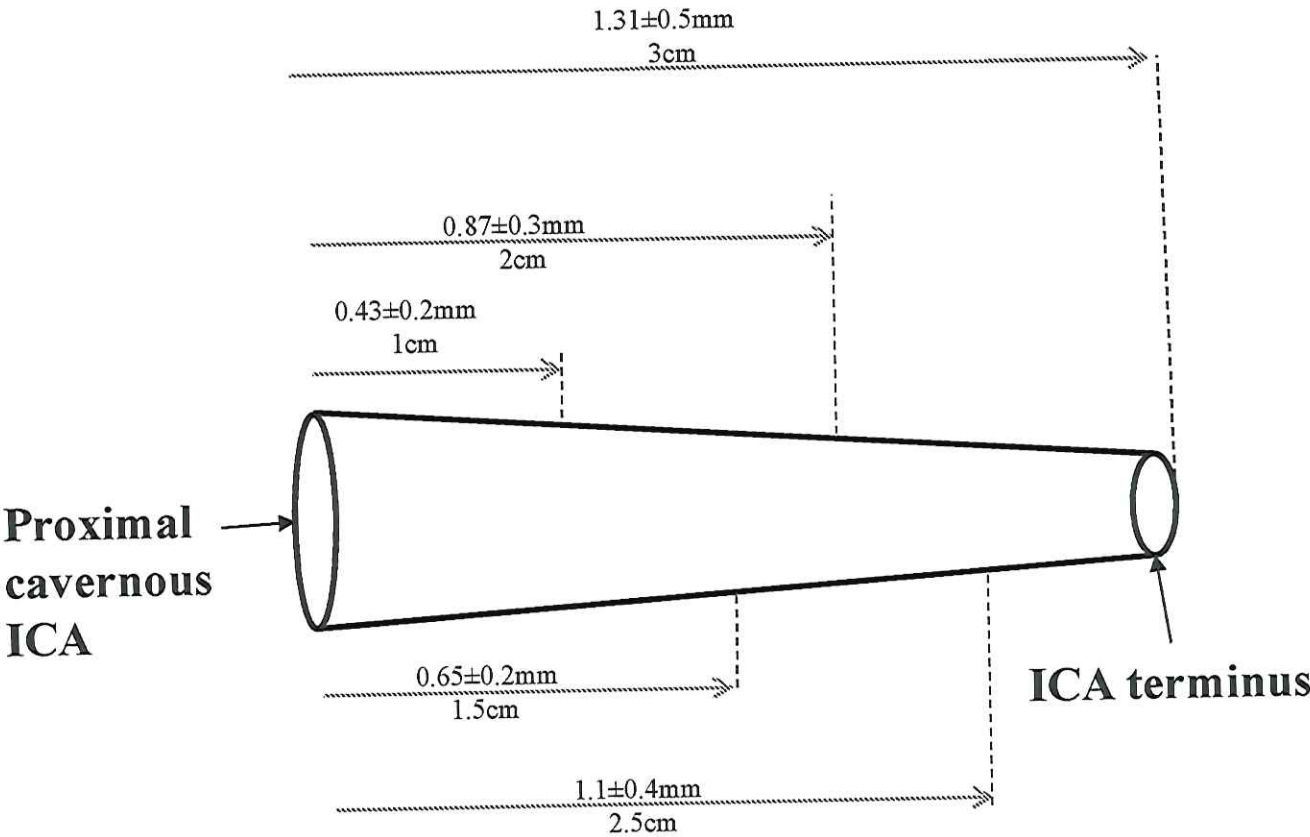


Fig. 2



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Fig. 3

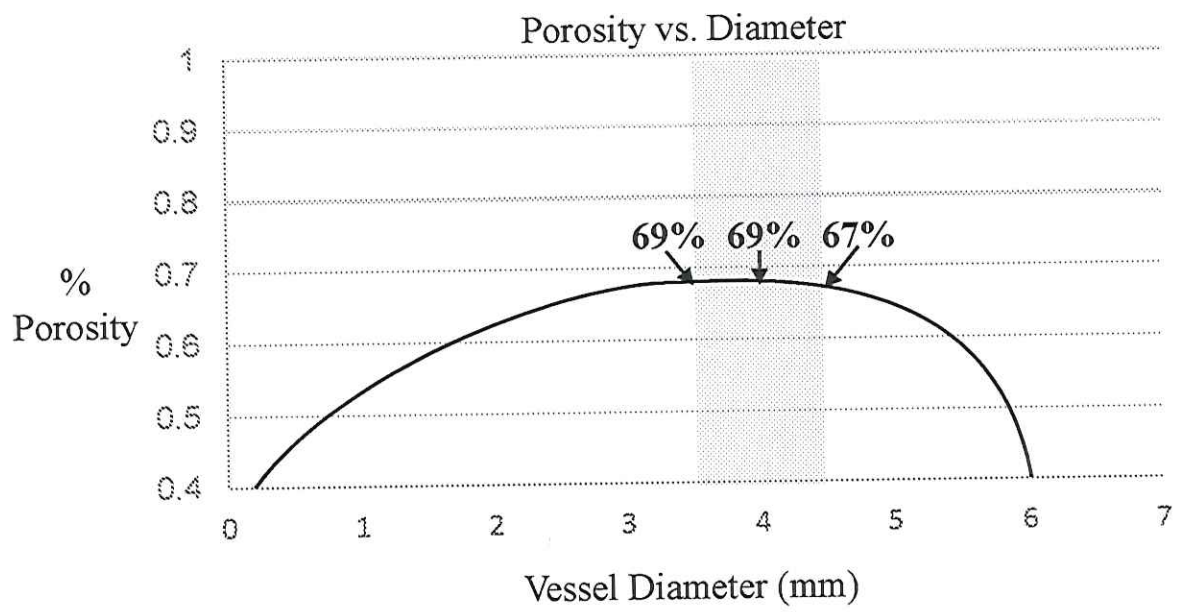
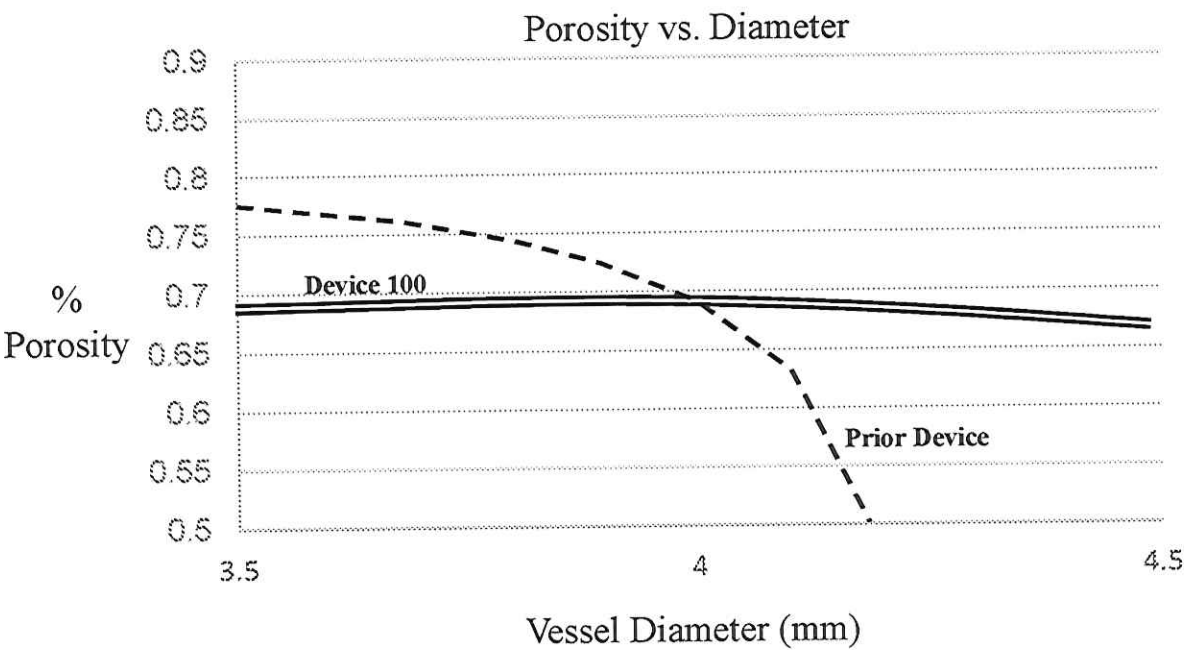


Fig. 4



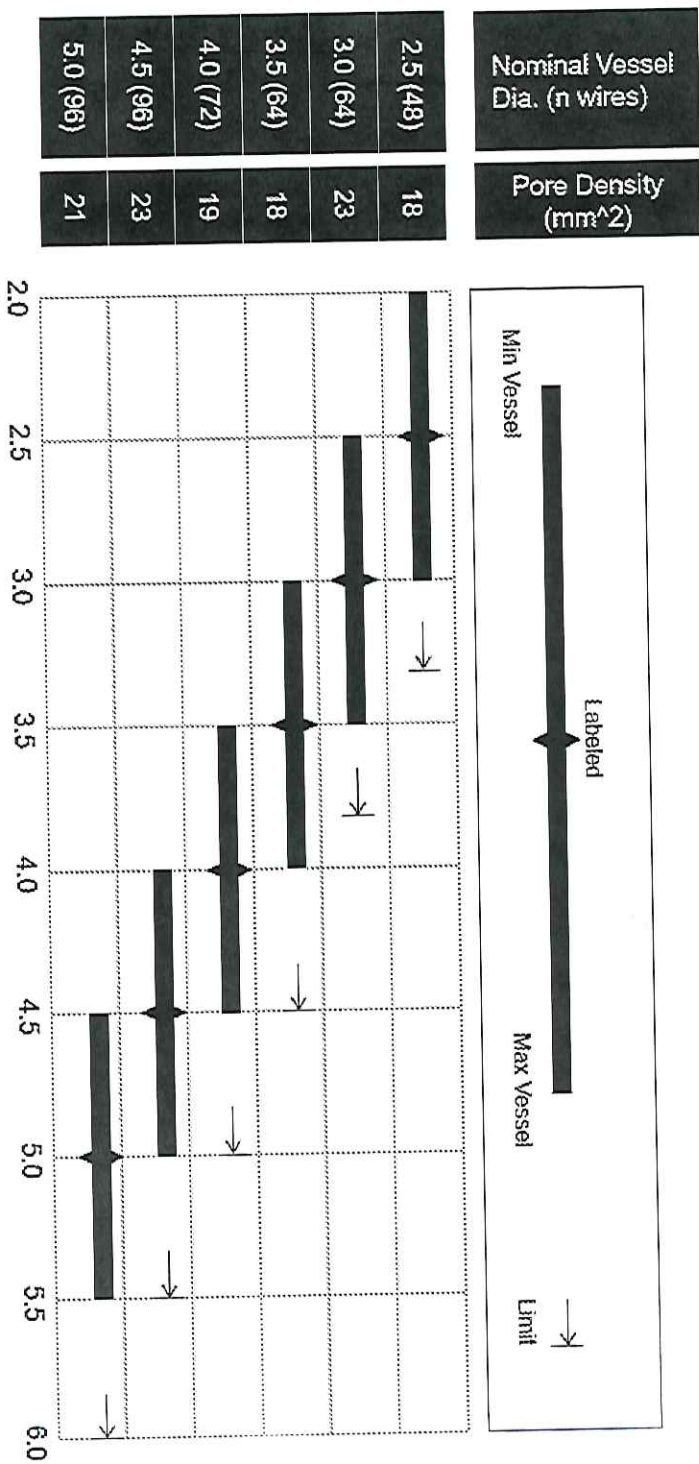


Fig. 5

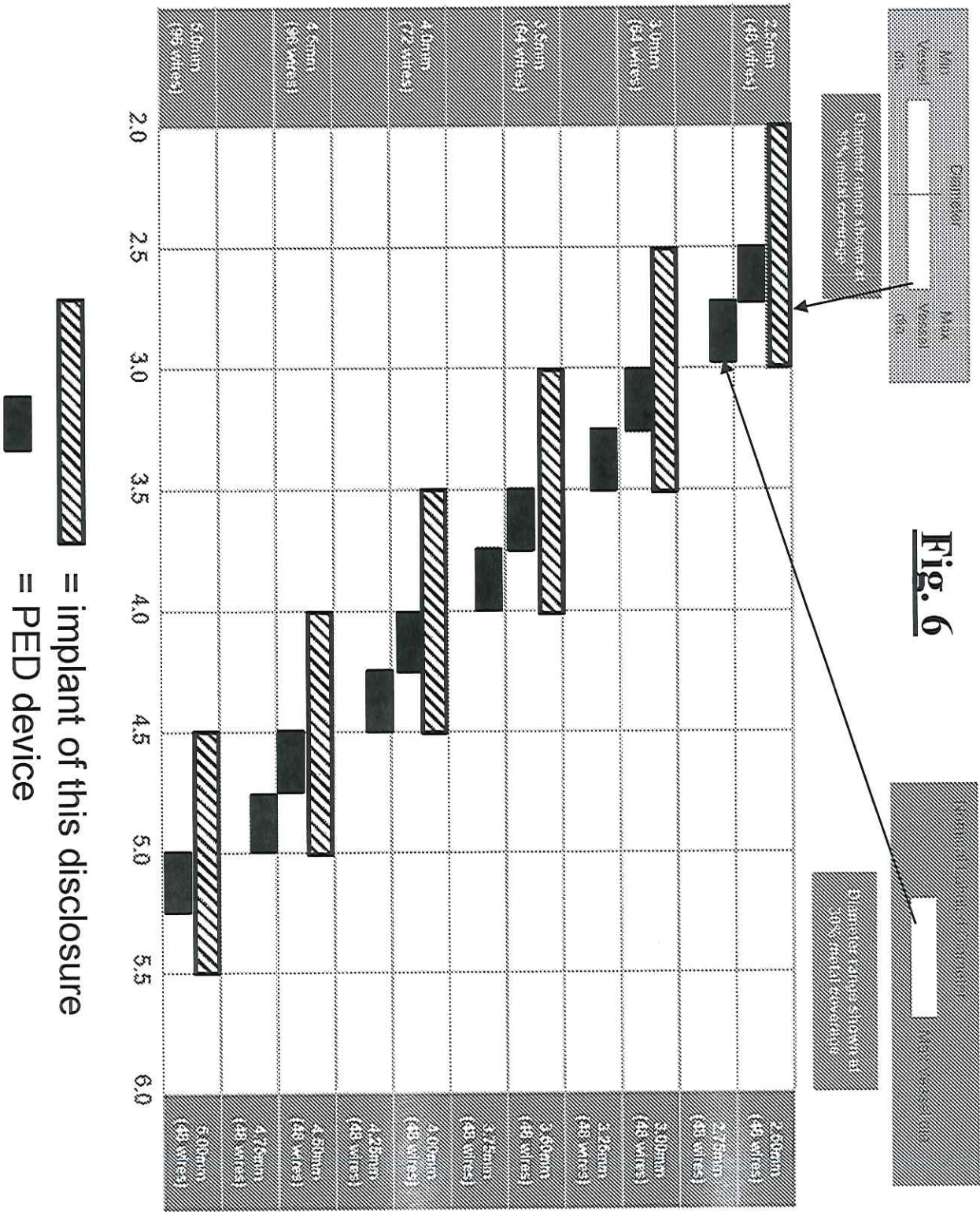
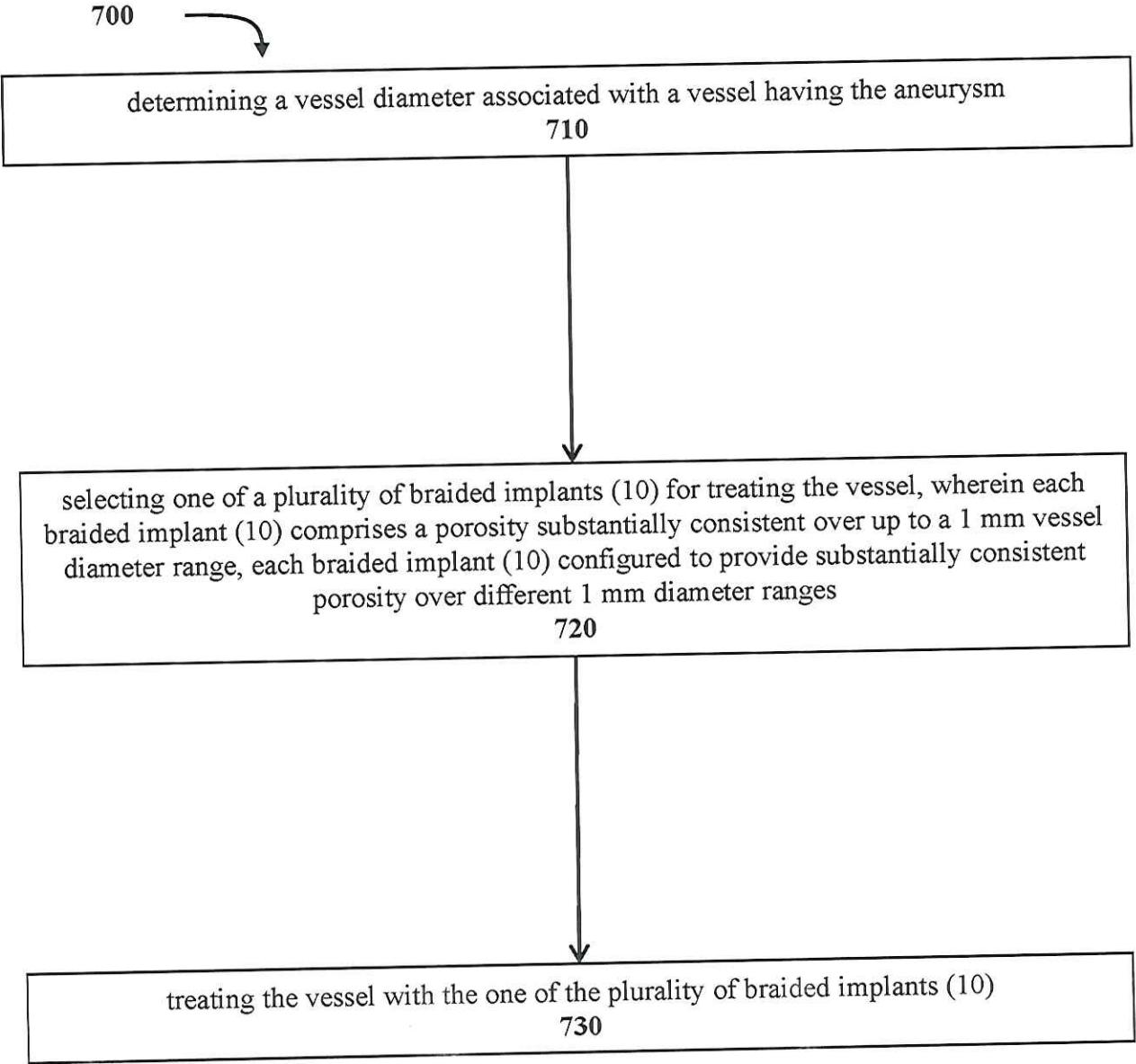
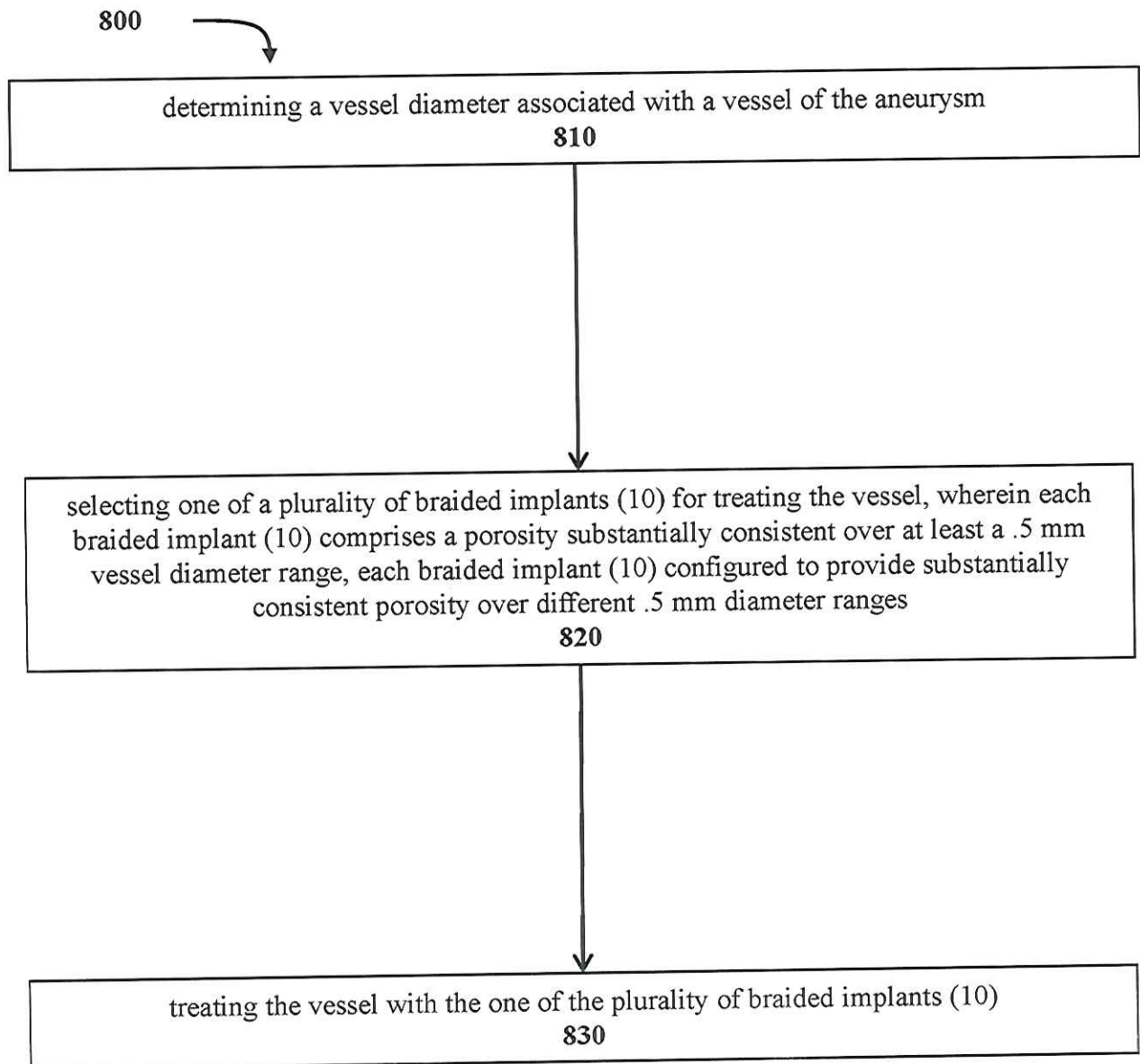


Fig. 7



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Fig. 8



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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	243382.000140
		Application Number	
Title of Invention	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT		
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
	Robert		SLAZAS	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Miami	State/Province	FL	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		

Inventor 2

Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Geoffrey		PETERS	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

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).

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	243382.000140
		Application Number	
Title of Invention	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT		

☐ 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	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT		
Attorney Docket Number	243382.000140	Small Entity Status Claimed ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	8	Suggested Figure for Publication (if any)	1

Filing By Reference:

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nnjg rgn l sk cpndrf c npt gns qw djb nnjg rgn	Dgg e b rc 'WWWV ,BB(	Grcjjcars j Npmcpw srf mrgwmpAns l rpw

Publication Information:

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

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

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). 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		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	243382.000140
	Application Number	
Title of Invention	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT	

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.

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 ⁹ (if applicable)

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

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	243382.000140
		Application Number	
Title of Invention	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT		

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.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	243382.000140
		Application Number	
Title of Invention	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT		

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

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

☒ Applicant

☐ Legal Representative under 35 U.S.C. 117

☐ Joint Inventor

☐ Non-applicant assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest

☐ 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.

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.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	243382.000140
		Application Number	
Title of Invention	SYSTEMS AND METHODS OF USING A BRAIDED IMPLANT		

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.

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

Countryⁱ 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.

Signature:

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. DeJuidice - 47,522/		Date (YYYY-MM-DD)	2018-08-06	
First Name	Louis	Last Name	DeJuidice	Registration Number	47522
Additional Signature may be generated within this form by selecting the Add button.					

Privacy Act Statement

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P-2019/36073

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

DIRECCIÓN DE NUEVAS CREACIONES

E. S. D.

Ref.: Expediente No. **NC2019/0008574**

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 **DEPUY SYNTHES PRODUCTS, INC.**, me permito dar respuesta al Oficio No. 8190 del 21 de agosto de 2019, de la siguiente manera

- 1. Prioridad:** Adjuntamos a la presente comunicación el documento de prioridad junto con su traducción.

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