

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
 Stylesheet Version v1.2

EPAS ID: PAT5070730

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT
CONVEYING PARTY DATA	
Name	Execution Date
SHANNON MAGUIRE	08/21/2015
JESSICA LIANG	03/21/2018
WENDY GRACZYK BEUTHIN	03/28/2018
TIN LUONG-UHL	03/21/2018
PETER SOLIMAN	09/29/2015
RECEIVING PARTY DATA	
Name:	TERUMO CORPORATION
Street Address:	2-44-1 HATAGAYA, SHIBUYA-KU
City:	TOKYO
State/Country:	JAPAN
Postal Code:	151-0072
PROPERTY NUMBERS Total: 3	
Property Type	Number
Application Number:	62348729
Application Number:	15619296
PCT Number:	US2017036872
CORRESPONDENCE DATA	
Fax Number:	(310)327-3466
<i>Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.</i>	
Phone:	3107557800
Email:	inskeepstaff@inskeplaw.com
Correspondent Name:	INSKEEP IP GROUP INC./JAMES W. INSKEEP
Address Line 1:	2281 WEST 190TH STREET
Address Line 4:	TORRANCE, CALIFORNIA 90504
ATTORNEY DOCKET NUMBER:	139318-584
NAME OF SUBMITTER:	JAMES W. INSKEEP, ESQ.
SIGNATURE:	/James W. Inskeep, Reg. No. 33,910/
DATE SIGNED:	07/27/2018

Total Attachments: 24

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ASSIGNMENT

WHEREAS, I/We, SHANNON MAGUIRE, JESSICA LIANG, WENDY GRACZYK BEUTHIN, TIN LUONG-UHL and PETER SOLIMAN, the ASSIGNOR(S) herein, has/have invented certain new and useful inventions disclosed in a Provisional application for United States Letters Patent entitled *Vessel Occluder* filed June 10, 2016 as Application Serial No. 62/348,729; a Nonprovisional application for United States Letters Patent entitled *Vessel Occluder* filed June 9, 2017 as Application Serial No. 15/619,296; and in an International Patent Application entitled *Vessel Occluder* filed June 9, 2017 as International Application No. PCT/US2017/036872; and

WHEREAS, TERUMO CORPORATION, a Corporation organized and existing under the laws of Japan, having a place of business at 2-44-1 Hatagaya, Shibuya-ku, Tokyo, 151-0072 Japan, the ASSIGNEE herein, desires to acquire the entire right, title and interest in and to said inventions, applications and Letters Patent to be granted and issued thereon;

NOW, THEREFORE, for and in consideration of the sum of One Dollar (\$1.00) by the ASSIGNEE to me paid, and other valuable consideration, the receipt and legal sufficiency all of which is hereby acknowledged, I/We, the said ASSIGNOR(S), has/have sold and do hereby sell, assign, transfer and set over unto said ASSIGNEE, its successors and assigns, the entire right, title and interest in and to said inventions and all improvements thereon, in and to said application for Letters Patent thereon, in and to applications pertaining to or based upon said inventions and applications, including divisional and continuing applications and continuations-in-part, and in and to any and all Letters Patent which may be granted and issued on said inventions and applications, or any of them, not only for, to and in the United States of America, its territories and possessions, but for, to and in all countries foreign thereto, together with and including all priority rights based upon any and all applications in the United States of America covered by this Assignment.

And for the above-named considerations, I/We do hereby agree that I/We will, at the request of said ASSIGNEE, execute any and all applications for Letters Patent for said inventions and any and all other papers and documents and do all other and further lawful acts that said ASSIGNEE may deem necessary or desirable to obtain Letters Patent on said inventions, to secure the grant of such Letters Patent and to perfect and vest in the ASSIGNEE the entire right, title and interest in the inventions, applications and Letters Patent.

And for the above-named considerations, I/We do hereby authorize and empower the ASSIGNEE, its successors and assigns, to apply for and obtain, in its or their own names, Letters Patent for the said inventions before competent International Authorities and in any and all countries foreign to the United States in which applications for Letters Patent can be so made or Letters Patent so obtained.

DATED at _____, this _____ day of _____, 20____.
(City, State)

Name: Shannon Maguire

DATED at Aliso Viejo, CA, this 21 day of March, 2018.
(City, State)

Jessica Liang
Name: Jessica Liang

DATED at Aliso Viejo, CA, this 28 day of March, 2018.
(City, State)

Wendy Graczyk Beuthin
Name: Wendy Graczyk Beuthin

DATED at Aliso Viejo CA, this 21 day of March, 2018.
(City, State)

Tin Luong-Uhl
Name: Tin Luong-Uhl

MV1 139318-584

DATED at _____, this _____ day of _____, 20____.
(City, State)

Name: Peter Soliman

ACCEPTED BY:

DATED at Tokyo Japan, this 17th day of July, 2018.
(City, State)

TERUMO CORPORATION
2-44-1 Hatagaya, Shibuya-ku
Tokyo, 151-0072
JAPAN

By:

Kayuhiko Uchida
Title: General Manager, Intellectual Property Dept.



Invention Disclosure and Assignment

FOR LAW DEPARTMENT USE ONLY

Invention Record No. 15-36

Submitted by Shannon Maguire	Date 9/17/2015	
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This form is for the reporting and assigning to MicroVention, Inc. any new thing or idea which might be patentable for the purpose of securing legal opinion or assistance in a legal proceeding. Please turn this form into the Legal department after completion.

Title:

Self-Flattening Internal Single Wire Mesh Occluder

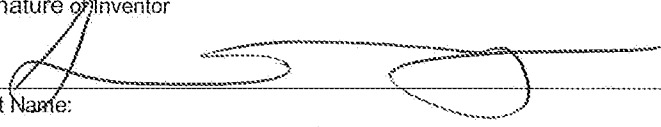

Inventor(s) (attach additional pages as necessary)

Name Shannon Maguire	Employee No. 2011
Residence 503 Alabama St Huntington Beach CA 92648	Citizenship USA
Name Peter Soliman	Employee No. 2123
Residence 11 Via Olorosa, Rancho Santa Margarita CA 92688	Citizenship USA
Name	Employee No.
Residence	Citizenship
Name	Employee No.
Residence	Citizenship
Name	Employee No.
Residence	Citizenship

Identify any previously filed Invention Records, by the same or other inventors, that directly relate to the present invention:



Invention Disclosure and Assignment

Signature of Inventor X 	Date 9/29/15
Print Name: Shannon Maguire	
Signature of Inventor X 	Date 9/29/15
Print Name: Peter Soliman	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	

Invention Disclosure and Assignment

DETAILED DESCRIPTION OF INVENTION: Provide a description of the idea and any possible variants. Include drawings, sketches, or photographs with a complete explanation. For chemical or process ideas give examples in sufficient detail to carry out the process or reaction. Attach any relevant test data, test records, drawings, or other data. Indicate the notebook number and pages where data is recorded and attach photocopies of the relevant pages.

Background:

Peripheral Occlusion devices function as a means to stop blood flow with one single device. These devices are used for indication ranging from trauma to GDA embolization. Occlusion devices can be put in both high and low flow areas and therefore must have sufficient radial force. Many of these indications require to get very distal in the vasculature and therefore may require use of a microcatheter. Expected occlusion time is preferred by Physicians for under 2 minutes.

Competitions:

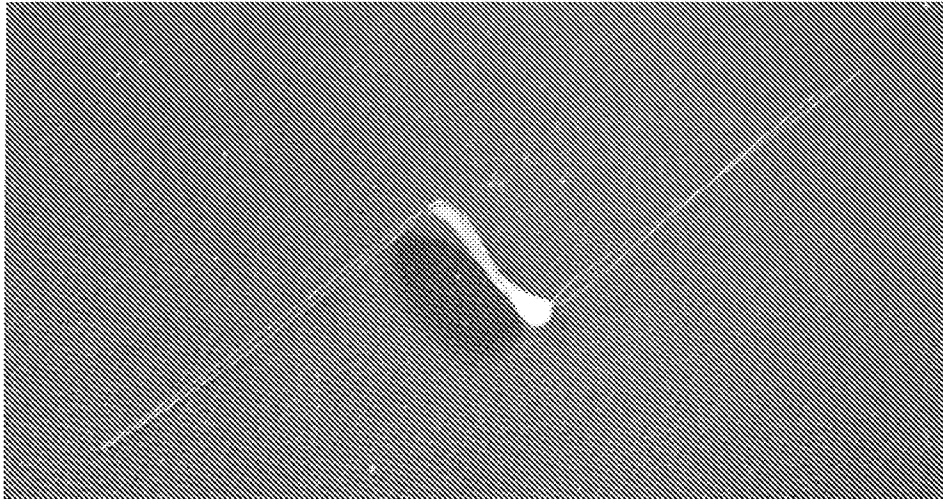
Competitors on the market, such as St. Jude's Amplatzer plugs, have been known to have less than optimal occlusion time. These devices consist of a single or double mesh layer of Nitinol heat set in different orientations. These specific devices have also been known to be categorized as too stiff during tracking through a catheter. They are also only compatible with 4F and above. Another competitor, MVP by Reverse Medical, has taken over a large portion of the market share. This specific occluder is composed of a laser cut nitinol cage covered in ePTFE. The comments about this device are that its occlusion time ranges from immediate to 7 minutes plus. It has the ability to be microcatheter compatible, but has minimal sizes. This device has also been known to migrate when put into high flow areas.

Proposed Design:

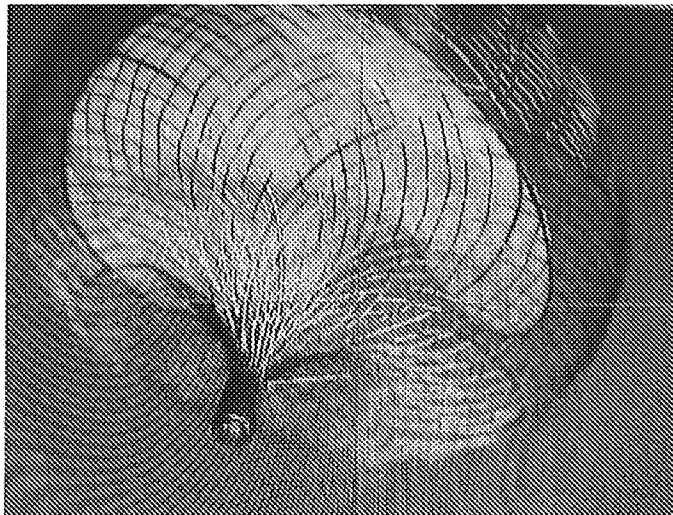
In this claim Nitinol wire will be used to create a heat-set shape, which will fold down on itself during deployment (see picture below). A thicker mesh braid will be used in a specified containing shape (see image below) to cage the nitinol heat-shape member so that a short landing zone is achieved. The Nitinol shaped internal member will have certain areas of stress, which will cause it to consistently fold in the same orientation. This stress can be applied by the following techniques: rolling so the wire becomes flat, selectively etching the wire to a smaller diameter, or heat setting the wire to form to the shape. The internal single wire shape will be covered in a type of membrane (ePTFE, silicone, polyurethane, etc) which will provide a barrier to blood in the vessel and therefore cause blood stasis and eventually occlusion. The internal member will be set inside the heat shaped mesh and secured by two radiopaque markers on each end. This entire implant will be attached to the V-trak detachment system.

See Notebook 436 pgs 142-143

Invention Disclosure and Assignment

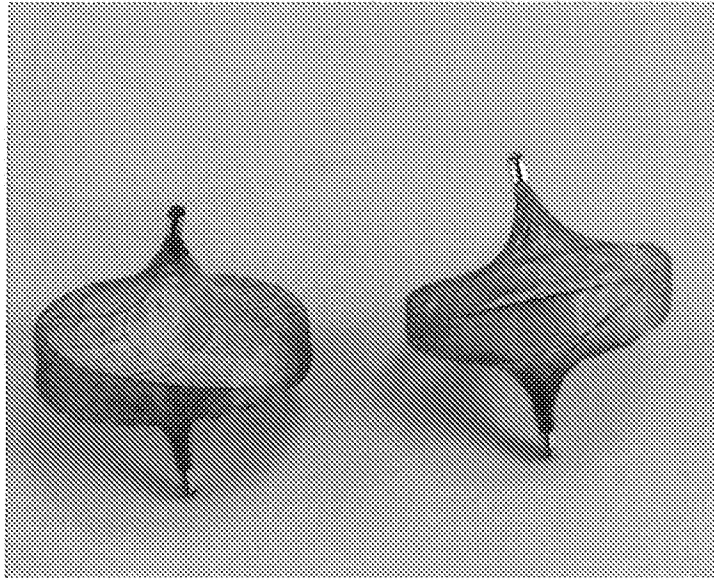


Self-Flattening Internal Member Coated in membrane



Internal member captured inside mesh

Invention Disclosure and Assignment



Final Design with Captured Ends



Invention Disclosure and Assignment

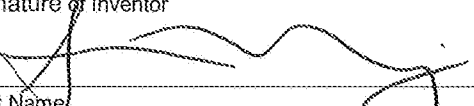
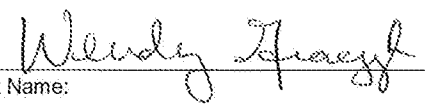
FOR LAW DEPARTMENT USE ONLY

Invention Record No.

Submitted by	Date	
Shannon Maguire	9/29/2015	
This form is for the reporting and assigning to MicroVention, Inc. any new thing or idea which might be patentable for the purpose of securing legal opinion or assistance in a legal proceeding. Please turn this form into the Legal department after completion.		
Title: Thin Film Nitinol Mesh Occluder		
Inventor(s) (attach additional pages as necessary)		
Name	Employee No.	
Shannon Maguire	2011	
Residence	Citizenship	
503 Alabama St Huntington Beach CA 92648	USA	
Name	Employee No.	
Wendy Graczyk <i>Wendy Graczyk</i>		
Residence	Citizenship	
646 Via Umbroso San Clemente CA 92672	USA	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
Identify any previously filed Invention Records, by the same or other inventors, that directly relate to the present invention:		



Invention Disclosure and Assignment

Signature of Inventor X 	Date 9/29/15
Print Name: Shannon Maguire	
Signature of Inventor X 	Date 9/29/15
Print Name: Wendy Graczyk	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	

Invention Disclosure and Assignment

DETAILED DESCRIPTION OF INVENTION: Provide a description of the idea and any possible variants. Include drawings, sketches, or photographs with a complete explanation. For chemical or process ideas give examples in sufficient detail to carry out the process or reaction. Attach any relevant test data, test records, drawings, or other data. Indicate the notebook number and pages where data is recorded and attach photocopies of the relevant pages.

Background:

Peripheral Occlusion devices function as a means to stop blood flow with one single device. These devices are used for indication ranging from trauma to GDA embolization. Occlusion devices can be put in both high and low flow areas and therefore must have sufficient radial force. Many of these indications require to get very distal in the vasculature and therefore may require use of a microcatheter. Expected occlusion time is preferred by Physicians for under 2 minutes.

Competitions:

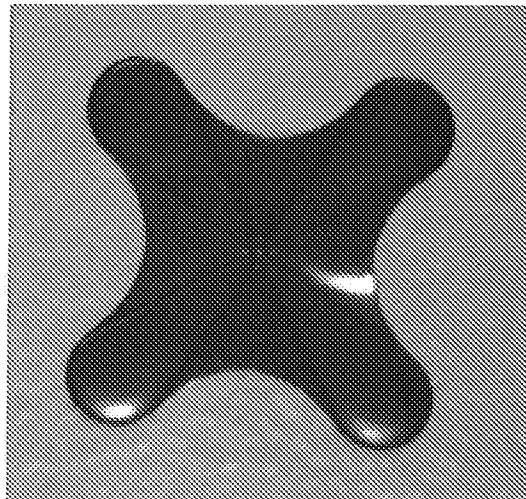
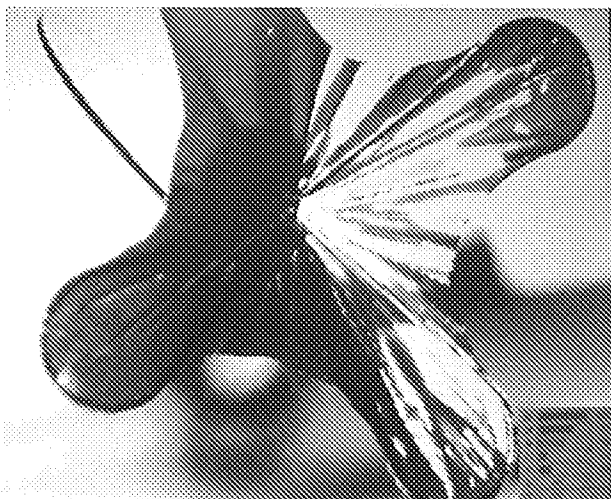
Competitors on the market, such as St. Jude's Amplatzer plugs, have been known to have less than optimal occlusion time. These devices consist of a single or double mesh layer of Nitinol heat set in different orientations. These specific devices have also been known to be categorized as too stiff during tracking through a catheter. They are also only compatible with 4F and above. Another competitor, MVP by Reverse Medical, has taken over a large portion of the market share. This specific occluder is composed of a laser cut nitinol cage covered in ePTFE. The comments about this device are that its occlusion time ranges from immediate to 7 minutes plus. It has the ability to be microcatheter compatible, but has minimal sizes. This device has also been known to migrate when put into high flow areas.

Proposed Design:

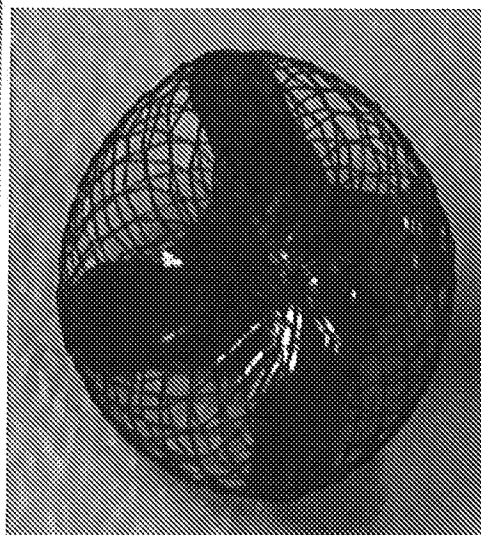
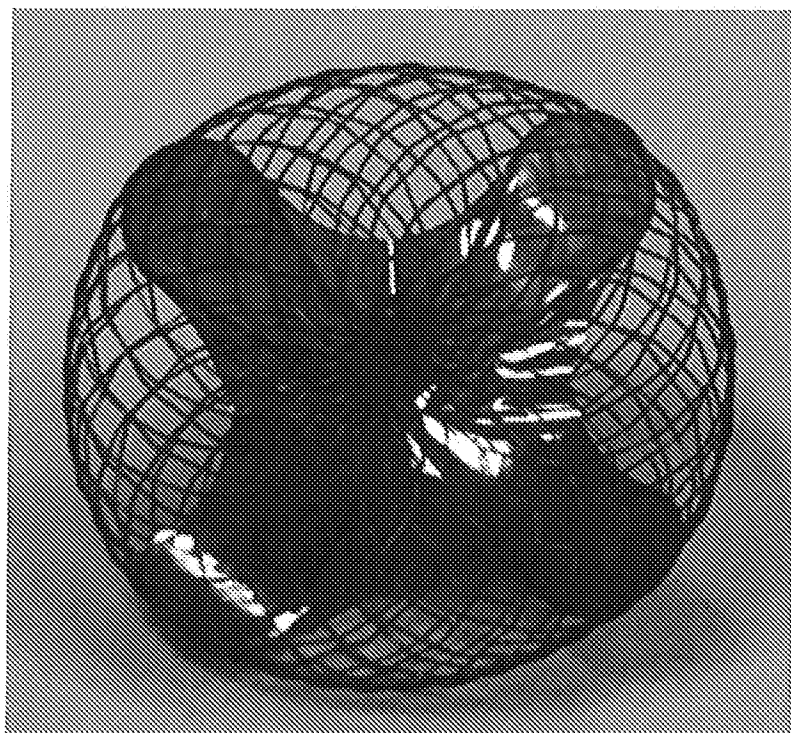
In this claim a thin film Nitinol structure (see image below) will be created by an outside vendor to be placed in a mesh cage. The thin film nitinol structure will serve as the main occlusive power of the device. The nitinol membrane will consist of a 2.5 dimensional shape which will sit in the cross sectional area of the vessel and occlude blood flow. The nitinol membrane is 5 microns thick with mesh pores ranging from 10-20 microns thick. Different thickness of the nitinol will aid in the collapsibility of the device. The thin film will be sputtered onto a mask in layers by a third party vendor. The thin film member will be placed inside of a braid and enclosed on both ends with marker bands. The mesh member will be heat set in a shape which will allow for a small landing zone as well as high radial force.

Lab Notebook 436 page 144

Invention Disclosure and Assignment



Thin Film Niti Structure



Finished Device(s)

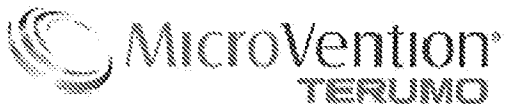


Invention Disclosure and Assignment

FOR LAW DEPARTMENT USE ONLY

Invention Record No.

Submitted by	Date	
Shannon Maguire	9/29/2015	
This form is for the reporting and assigning to MicroVention, Inc. any new thing or idea which might be patentable for the purpose of securing legal opinion or assistance in a legal proceeding. Please turn this form into the Legal department after completion.		
Title: MicroVention Medical Device Spring membrane occluder		
Inventor(s) (attach additional pages as necessary)		
Name	Employee No.	
Shannon Maguire	2011	
Residence	Citizenship	
503 Alabama St Huntington Beach CA 92648	USA	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
Identify any previously filed Invention Records, by the same or other inventors, that directly relate to the present invention:		



Invention Disclosure and Assignment

Signature of Inventor X 	Date 9/29/15
Print Name: Shannon Maguire	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	

Invention Disclosure and Assignment

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Background:

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Competitors on the market, such as St. Jude's Amplatzer plugs, have been known to have less than optimal occlusion time. These devices consist of a single or double mesh layer of Nitinol heat set in different orientations. These specific devices have also been known to be categorized as too stiff during tracking through a catheter. They are also only compatible with 4F and above. Another competitor, MVP by Reverse Medical, has taken over a large portion of the market share. This specific occluder is composed of a laser cut nitinol cage covered in ePTFE. The comments about this device are that its occlusion time ranges from immediate to 7 minutes plus. It has the ability to be microcatheter compatible, but has minimal sizes. This device has also been known to migrate when put into high flow areas.

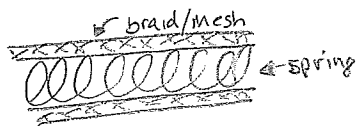
Proposed Design:

In this claim a thin membrane collapsible structure, such as thin film Niti or ePTFE (see image below) will be used to bunch inside a mesh cage. The thin film nitinol structure will serve as the main occlusive power of the device. The thin membrane will be attached to a spring, which will be attached to either end of the finished device (compacted inside of the end marker bands). There will be multiple layers of the thin membrane along the length of the spring. When the device is stretched down to be loaded into the catheter the thin membranes will collapse sequentially. When the device exits the catheter the spring will snap back into its relaxed state bringing the thin films along with it to layer upon each other. The thin layers will provide a membrane which will serve as the occlusive aspect of the design. The mesh braid which captures the entire spring subassembly will serve to provide wall apposition and radial force as well as shape determination. The two marker bands on either side of the finished device will capture the spring.

Mesh design



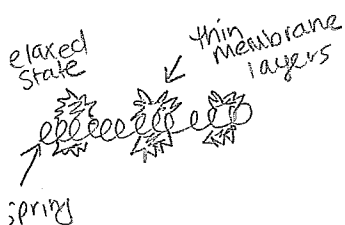
Inside catheter



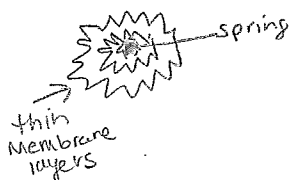
outside/relaxed



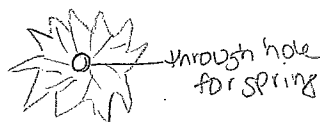
Internal Spring



Cross sectional

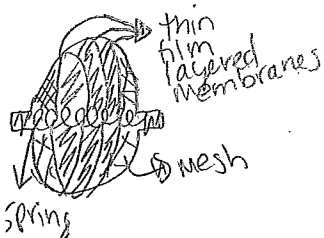


thin Membrane (alone)

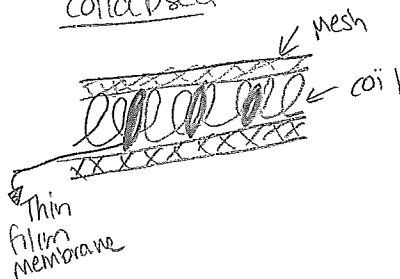


Finished device

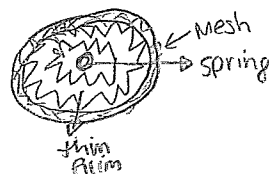
relaxed



collapsed



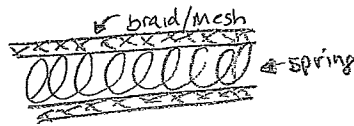
Cross sectional



Mesh design



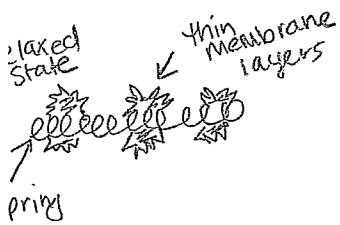
Inside catheter



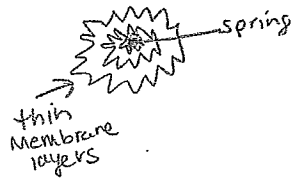
outside/relaxed



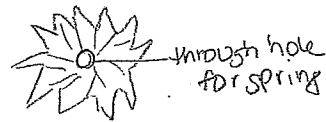
Internal Spring



cross sectional

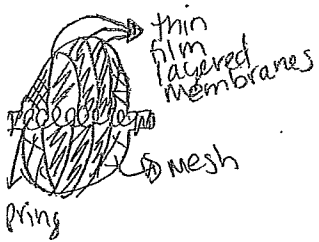


thin Membrane (alone)

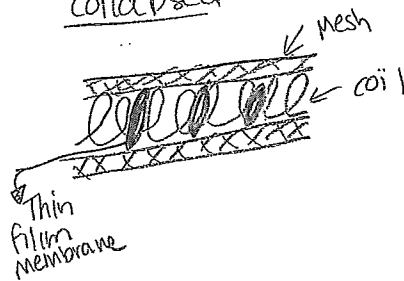


finished device

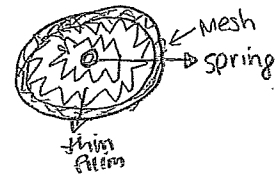
relaxed



collapsed



cross sectional





Invention Disclosure and Assignment

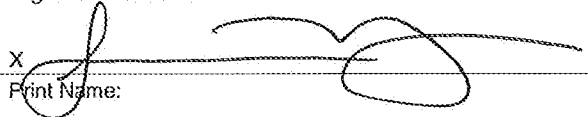
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Invention Record No. 15-30

Submitted by Shannon Maguire	Date 6/11/2015	
This form is for the reporting and assigning to MicroVention, Inc. any new thing or idea which might be patentable for the purpose of securing legal opinion or assistance in a legal proceeding. Please turn this form into the Legal department after completion.		
Title: spherical gel caged plug		
Inventor(s) (attach additional pages as necessary)		
Name Shannon Maguire	Employee No. 2011	
Residence 503 Alabama St Huntington Beach, CA 92648	Citizenship USA	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
Name	Employee No.	
Residence	Citizenship	
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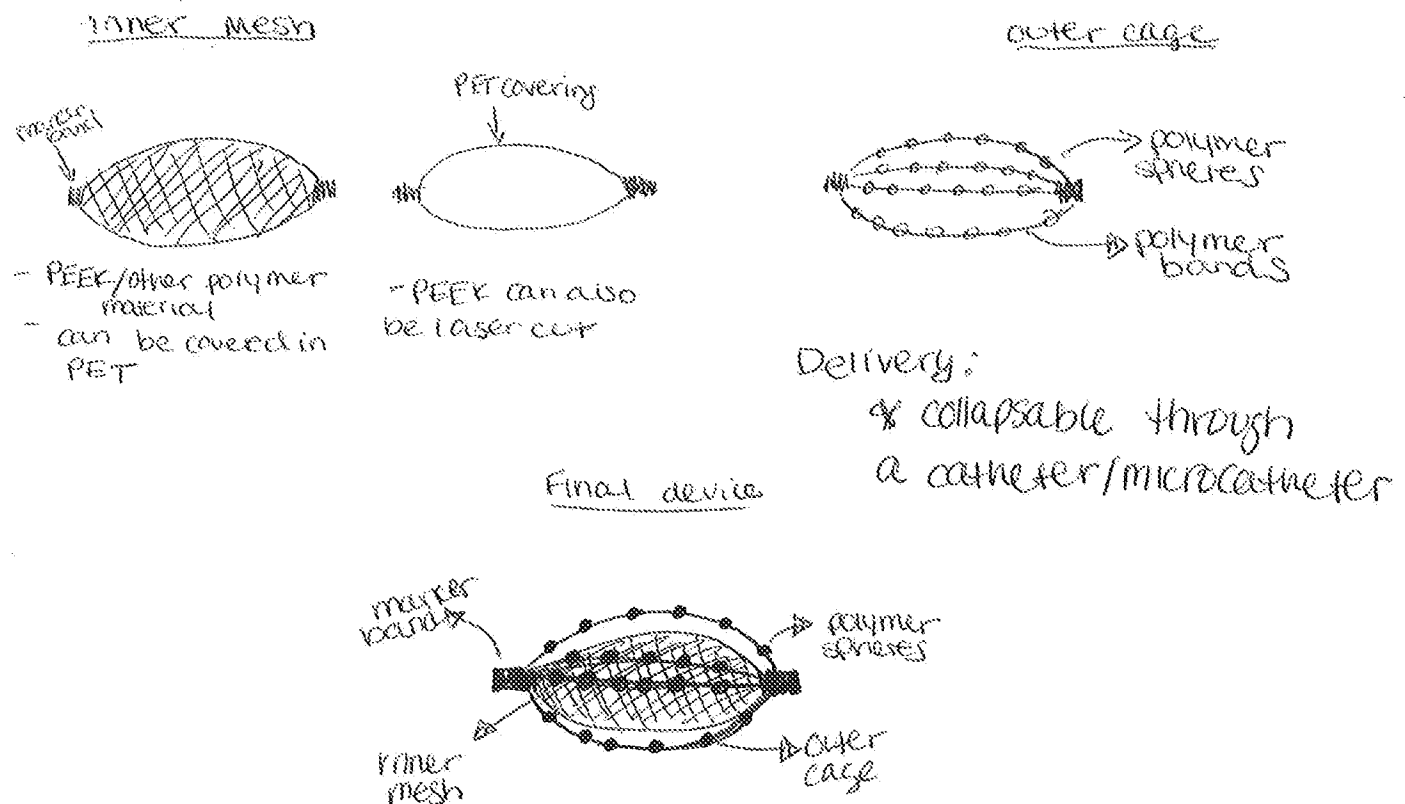
Invention Disclosure and Assignment

Signature of Inventor <input checked="" type="checkbox"/> 	Date 6/11/15
Print Name: Shannon Maguire	
Signature of Inventor <input checked="" type="checkbox"/>	Date
Print Name:	
Signature of Inventor <input checked="" type="checkbox"/>	Date
Print Name:	
Signature of Inventor <input checked="" type="checkbox"/>	Date
Print Name:	
Signature of Inventor <input checked="" type="checkbox"/>	Date
Print Name:	
Signature of Inventor <input checked="" type="checkbox"/>	Date
Print Name:	

Invention Disclosure and Assignment

DETAILED DESCRIPTION OF INVENTION: Provide a description of the idea and any possible variants. Include drawings, sketches, or photographs with a complete explanation. For chemical or process ideas give examples in sufficient detail to carry out the process or reaction. Attach any relevant test data, test records, drawings, or other data. Indicate the notebook number and pages where data is recorded and attach photocopies of the relevant pages.

Peripheral embolization plugs are intended to block the rate of blood flow in high flow peripheral vessels with one device. The indications of this product can range anywhere from trauma to total vessel occlusion. The design in this disclosure is intended to have a quick occlusion time by using a fine pored mesh inner technology covered by a "cage-like" outer technology, which will use polymer spheres to assist in occlusion time as well as neointimal growth. In the past, Nitinol has been used to create mesh-like plugs; however the corrosion factor of the Nitinol and the gel would require multiple post processing steps. Therefore, PEEK or another polymer with heat-shaping technology would be used to create this design. Polymer spheres will be threaded along the outer cage polymer bands, which will swell in the presence of the pH of blood. Both layers of the device would be pulled together and held down at each end with marker bands. This claim will also include covering the inner pored mesh with PET to create more surface area covered and therefore a quicker occlusion time. Drawings of the devices can be seen below.





Invention Disclosure and Assignment

FOR LAW DEPARTMENT USE ONLY

Invention Record No. 15-29

Submitted by

Shannon Maguire

Date

8/21/2015

This form is for the reporting and assigning to MicroVention, Inc. any new thing or idea which might be patentable for the purpose of securing legal opinion or assistance in a legal proceeding. Please turn this form into the Legal department after completion.

Title: Internal Coated Mesh Occluder

Inventor(s) (attach additional pages as necessary)

Name

Shannon Maguire

Employee
No.

2011

Residence

503 Alabama St Huntington Beach CA 92648

Citizenship

USA

Name

TIN LUONG-UHL

Employee
No.

1266

Residence

1929 Keswick Ln Huntington Beach CA 92646

Citizenship

USA

Name

Employee
No.

Residence

Citizenship

Name

Employee
No.

Residence

Citizenship

Name

Employee
No.

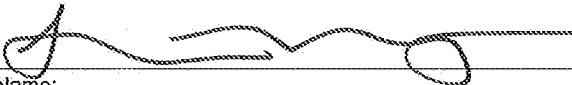
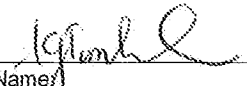
Residence

Citizenship

Identify any previously filed Invention Records, by the same or other inventors, that directly relate to the present invention:



Invention Disclosure and Assignment

Signature of Inventor X 	Date 8/21/15
Print Name: Shannon Maguire	
Signature of Inventor X 	Date 8/20/15
Print Name: Tin Luong - UHL	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	
Signature of Inventor X	Date
Print Name:	

Invention Disclosure and Assignment

DETAILED DESCRIPTION OF INVENTION: Provide a description of the idea and any possible variants. Include drawings, sketches, or photographs with a complete explanation. For chemical or process ideas give examples in sufficient detail to carry out the process or reaction. Attach any relevant test data, test records, drawings, or other data. Indicate the notebook number and pages where data is recorded and attach photocopies of the relevant pages.

Peripheral embolic plugs are designed to be deployed within a blood vessel and prohibit blood flow. These devices are intended to be single use and occlude the target vessel with a single device. The intended indications for this device range from trauma applications to total vessel occlusion such as in PAVMs (pulmonary arteriovenous malformation). Competitors, such as EV3, use a laser cut nitinol basket coated in ePTFE to stop blood flow. Another competitor, St. Jude, uses different Nitinol mesh designs to prohibit blood flow through the device. The designs in this disclosure will use a nitinol wire formed structure as an internal structure as well as a mesh outer structure. The internal member will be coated in a material to add occlusive properties to the device. This design will address current issues of migration and sheared coating. The internal member will be used to increase radial force as well while the outer member will protect the coating from shearing. This will be a single device and will have its own detachment system.

A) Claim I- Internal Laser Cut

- a. An internal laser cut nitinol structure will be used to provide radial force to the overall device. A coating, in this case ePTFE, is added to the internal structure to provide a pocket where blood will pool and clot within the body. Other materials such as polyester, bioweb, and polyurethane will also be captured within this claim. The mesh structure will be heat set in a specific shape (sphere, cylinder, or hourglass) to provide better stability in the vessel. This device will be fully retractable and be attached to Vtrak (or a similar) detachment system. See Image 1 for more detail of the device.

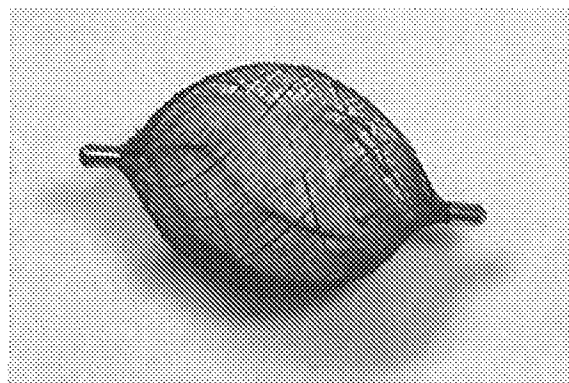


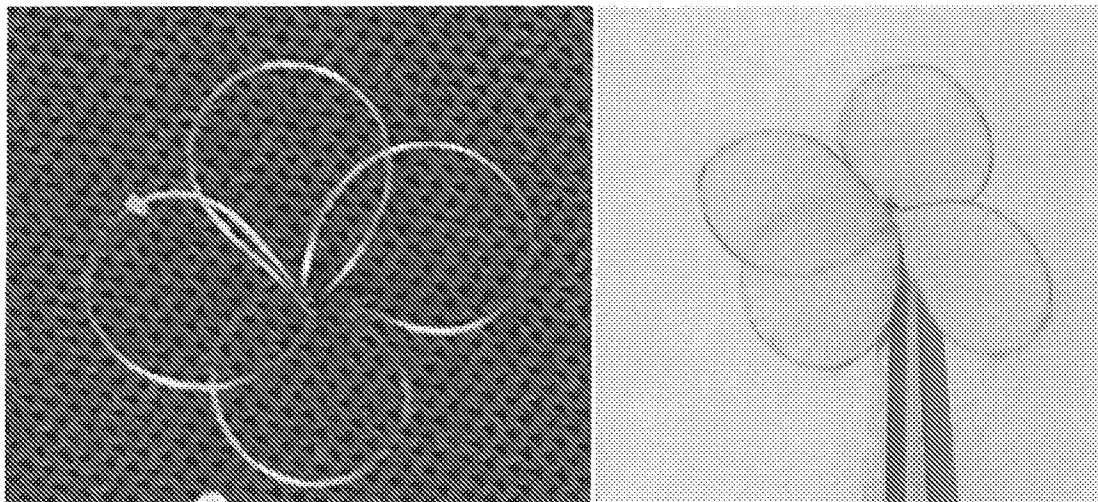
Image 1

B) Claim II- Internal Clover Design

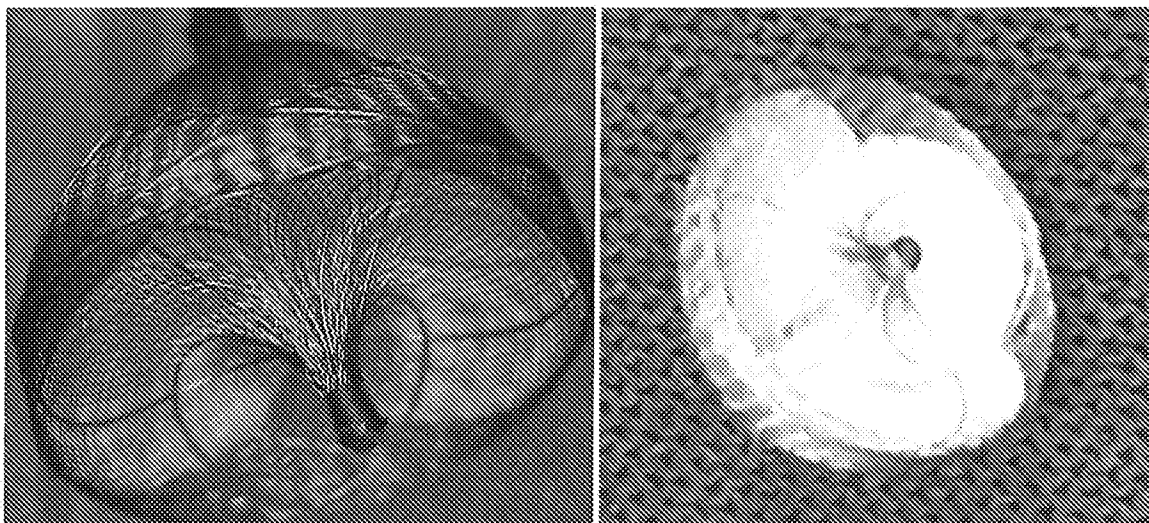
- a. The internal structure of the device will be developed using wires of nitinol (or another heat shape memory material) to provide radial force as well as a structure to coat (see Image 2). The clover will be developed by using 4 individual wires, which will be laser welded together at the tip in a marker band. These 4 wires will then be heat set to

Invention Disclosure and Assignment

make the flat, open face clover design. This structure will be coated in polyester, ePTFE, or alike materials (see Image 3). The coated clover member will then be inserted into a mesh structure (Images 4 and 5), which will be heat set prior into a specific shape. The two structures will be secured together at both ends with marker bands. This device will be full retractable and attached to Vtrak (or a similar) detachment system. See Images 2, 3 and 4 for more detail of the device.



Images 2 and 3



Images 4 and 5