A grip assembly for an embolic delivery device is described, where said grip assembly includes an integral wiping system utilizing one or more wipers. The grip assembly is constructed and arranged to allow an embolic delivery device to be inserted into the grip quickly and easily, without shifting undue attention away from the patient to the device. The wiper or wipers prevent any fluids or debris that may be present on a proximal end of the embolic delivery device from entering the interior of the grip assembly, thereby preserving a clean environment for making solid electrical connections between contacts in the grip assembly and corresponding contacts on the embolic delivery device.
INTEGRAL WIPING SYSTEM AND METHOD

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application Serial No. 61/770,198 filed February 27, 2013 entitled Integral Wiping System, which is hereby incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] Embolic agents, such as coils, are often used to treat various intravascular conditions such as arteriovenous malformations (AVM), aneurysms, and fistulas. These agents fill the cavity and limit blood flow to these regions to reduce the chance of any bursting of the blood vessel. Embolic delivery systems must have a precise detachment mechanism to ensure proper and reliable detachment of the embolic agent once they are placed within the treatment site. One example of an embolic delivery system utilizes a pusher system and a grip system which the pusher system is inserted into. The grip system has a series of electrical contacts and when particular elements of the pusher system line up with the electrical contacts, a detachment sequence can be initialized by the user. This detachment sequence can be initiated by depressing a button on the grip system to release the embolic agent.

[0003] Blood, saline, or other fluids can cause contamination of these electrical contacts and may cause deterioration of the connection integrity between the pusher system and grip system. Deterioration of the connection integrity may result in the detachment sequence not functioning correctly. The inclusion of one or more wipers between the sets of contacts is one technique to reduce the potential of fluid to degrade these electrical contacts.
SUMMARY OF THE INVENTION

[0004] A grip assembly for an embolic delivery device is described, where the grip assembly includes an integral wiping system utilizing one or more wipers. The wipers are positioned and sized to engage a proximal end portion of an electrical medical device, such as an embolic delivery device, such that electrical contacts on the proximal end portion are wiped clean while being inserted into the grip assembly.

[0005] One aspect of the invention pertains to a grip assembly for a medical delivery system that includes a housing defining at least one channel sized to receive a proximal end of a medical delivery system; an electrical contact contained within the at least one channel and positioned to establish an electrical connection with an electrical contact on an external surface of the medical delivery system; and at least one annular wiper disposed within the housing and having a diameter smaller than a diameter of the proximal end of the medical delivery system, thereby creating an interference fit between the wiper and the medical delivery system, when the medical delivery system is inserted in the housing, that prevents dirt and/or fluid on the medical delivery system from passing by the wiper.

[0006] The at least one channel may comprise a plurality of channels. These channels may be coaxial in order to accommodate a medical delivery system that uses a single-pronged male connector configuration. This configuration is advantageous as it is easily inserted into the channels without regard to orientation.

[0007] In one aspect of the invention, the at least one wiper comprises a plurality of annular wipers, each of the wipers placed proximate one of the plurality of coaxial channels. These wipers and channels may be arranged in an alternating configuration.

[0008] Another aspect of the invention pertains to a grip assembly for controlling an electrical medical device comprising: at least one channel for receiving a proximal portion of the medical device; an electrical contact for establishing an electrical connection with a corresponding electrical contact on the proximal portion of the medical device; a power supply operably associated with the electrical contact for supplying the medical device with
electricity; and at least one wiper coaxial with the at least one channel and having an inner
diameter smaller than the at least one channel, such that when the medical device is
inserted into the at least one channel, an interference fit is established between the medical
device and the at least one wiper such that fluid and/or debris are prevented from entering
the at least one channel.

[0009] Another aspect of the invention pertains to a method of establishing a clean
electrical connection between a powered grip and a medical device inserted into the grip
comprising providing at least one wiper in the grip, the wiper disposed to interfere with an
electrical contact on a medical device being inserted into the grip without preventing the
medical from being inserted into the grip.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other aspects, features and advantages of the invention will be
apparent and elucidated from the following description of embodiments of the present
invention, reference being made to the accompanying drawings, in which:

[0011] Figure 1 is a perspective view of an embodiment of a grip system used as part of
an embolic delivery system of the invention;

[0012] Figure 2 is a perspective view of an embodiment of a pusher/grip connector of
the invention;

[0013] Figure 3 is an exploded elevation of the embodiment of the grip system of Figure
1;

[0014] Figure 4 is an exploded perspective view of the embodiment of the grip system of
Figure 1;

[0015] Figure 5 is an elevation of an embodiment of a circuit board for use with the grip
system of the invention;
Figure 6 is a detailed cutaway view of an embodiment of an integral wiping system of the invention; and

Figure 7 is a detailed cutaway view of an embodiment of an integral wiping system of the invention.

DESCRIPTION OF EMBODIMENTS

Specific embodiments of the invention will now be described with reference to the accompanying drawings. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. The terminology used in the detailed description of the embodiments illustrated in the accompanying drawings is not intended to be limiting of the invention. In the drawings, like numbers refer to like elements.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

Figure 1 illustrates a grip system 10 used as part of an embolic delivery system 1. The embolic delivery system 1 can be used, for example, to deliver embolic coils to a treatment site within the vasculature. The embolic delivery system 1 includes grip system 10, and a separate pusher system 80, which is inserted into grip system 10. The pusher system 80, which is connected to the embolic coil, can be inserted into the grip system 10 in order to facilitate deployment and detachment of the coil once the coil is delivered to a target site in the vasculature.
[0021] Figures 3-7 detail the various components of the grip system 10. Externally, grip system 10 has a top housing 12 and bottom housing 14, and a funnel 18 that is part of a pusher/grip connector 20 that is best seen in Figure 2. The pusher/grip connector 20 includes funnel 18, push button 16, and contains channels 22, 24, 26, 28. Although four channels are shown in Figure 2, fewer or more channels can be used. These channels contain electrical connections which are used to detect when the pusher system 80 is correctly inserted into grip system 10 and when the embolic coils connected to the pusher system 80 can be detached within the vasculature.

[0022] In the embodiment shown in Figure 2, the funnel 18 narrows to an opening that is coaxial with all four channels 22, 24, 26 and 28. This embodiment is designed for use with a pusher system 80, such as that shown in Figure 1, that has a proximal end 81 having a plurality of external, circumferential electrical contacts 82, 84, 86 and 88. These contacts correspond to the channels 22, 24, 26 and 28. As such, when the proximal end 81 is pushed into the grip system 10, the funnel 18 directs the end 81 into the channels 22, 24, 26 and 28, without requiring the physician to shift focus away from the procedure being performed. An advantage to the axial design shown in Figure 2 is that electrical connections are established without requiring a specific orientation of the pusher system 80 relative to the grip system 10.

[0023] Figure 3 is an exploded view of the grip system 10 from Figure 1, showing more of the components. In addition to a top housing 12, bottom housing 14, and a pusher/grip connector 20, the grip system 10 also includes a control system 30. Control system 30 includes a power source 42, which is connected to circuit board 44. In one example, batteries can be used as a power source. In another example, three 12 Volt batteries can be used as a power source. In another example, a single 9 Volt battery can be used as a power source. Figure 4 offers an exploded view showing an example of a power source, in this case a three battery power source 42.

[0024] Figure 3 shows that control system 30 is connected to channels 22, 24, 26, 28 of the pusher/grip connector 20 via corresponding connectors 32, 34, 36, 38, which are
inserted into the channels. Connectors 32, 34, 36, 38 are in turn connected to circuit board 44 as a part of control system 30.

[0025] Circuit board 44 is shown in greater detail in Figure 5. The circuit board is connected to a back button 46. Back button 46 sits directly behind push button 16 of the pusher/grip connector 20. When the user pushes button 16, button 16 impinges back button 46 and this action is relayed through control system 30 via circuit board 44. Control system 30 includes a light 48 mounted to circuit board 44. Light 48 indicates when the leads within pusher/grip connector 20 are lined up correctly and the detachment sequence can be initiated. One color light (i.e. green) indicates the leads are lined up correctly and the detachment sequence can initiate. Another color light (i.e. red) indicates the detachment sequence cannot initiate as the signal is not registering properly. An audible alarm 50 is also included to audibly indicate that the detachment sequence can be initiated.

[0026] Connectors 32, 34, 36, 38 of control system 30 are mounted to circuit board 44 and fit within corresponding channels 22, 24, 26, 28 within pusher/grip connector 20. Although four connectors and four channels are shown in the Figures, fewer or more connectors and channels can be used. The connectors sense when a proper connection is made between the leads of the pusher system and the electrical connections of the pusher/grip connector, and thus when a detachment sequence can be initiated. The connectors can be made of any conductive metal.

[0027] Figures 6-7 illustrate the interface between pusher/grip connector 20 and pusher system 80. Figure 6 shows the pusher/grip connector 20 and the series of channels 22, 24, 26, 28. The channels contain a series of contacts 52, 54, 56, 58 respectively housed in each channel. Connectors 32, 34, 36, 38 are in turn connected to circuit board 44 as a part of control system 30.

[0028] The user inserts pusher system 80 into the pusher/grip connector 20. The proximal end of pusher system 80 is pushed into pusher/grip connector 20 of grip system 10, while a distal end of the pusher system sits within the vasculature system. The distal end of pusher system 80 is connected to an embolic agent, such as embolic coil (not
shown). At a more distal portion of the pusher system, a release agent such as a heater coil can be used to release the embolic coils from the pusher system when desired. The heater coil would heat a junction between pusher system 80 and the embolic coil, causing the coils to sever and detach within the vasculature.

[0029] Pusher system 80 has a number of contacts 82, 84, 86, 88 which mate with corresponding contacts 52, 54, 56, 58 of the pusher/grip connector 20 in a male/female relationship. Pusher system 80 may have a number of blank leads 92, 94, 96, 98 which sit between contacts 82, 84, 86, 88. These blank leads correspond to sections of pusher/grip connector 20 which do not have contacts. Alternatively, pusher system 80 may have a solid contact block which interfaces with contacts 52, 54, 56, 58. In one example pusher system 80 is comprised of one solid contact block made of stainless steel with gold plating. In another example contact sections 82, 84, 86, 88 are made of stainless steel with gold plating and sections 92, 94, 96, 98 have an epoxy coating. In another example sections 82, 84, 86, 88, 92 are made of stainless steel with gold plating and the rest of the sections have an epoxy coating. In another example sections 82, 84, 86, 88, 92, 98 are made of stainless steel with gold plating and the rest of the sections have an epoxy coating. Although Figures 6-7 show four contacts within pusher/grip connector 20 and four contacts on pusher system 80, more or fewer contacts can be used.

[0030] Sections of pusher/grip connector 20 which do not have contacts have wipers 70 filling the space. Ordinarily, any fluid accumulation on any section of pusher system 80 can result in deterioration of connection integrity between the pusher contacts and the pusher/grip contacts. Deterioration in connection integrity can cause the detachment sequence to not initiate properly. The user may be able to manually wipe the leads 80 to remove any liquid, however, the wiping apparatus the user uses may be corrupted with liquid (such as blood or saline). Wipers 70 wipe away any liquid which may accumulate on pusher system 80, thus reducing the chance of the connection integrity failing, thus reducing the chance of the detachment sequence not initiating properly. The wipers may be made out of materials which promote absorption of typical contaminating liquids such as saline and blood. Absorbable substances such as paper, cloth, sponge, or polymeric
material could be used. The wipers may take on a plurality of shapes, i.e. circular, ellipsoid, rectangular, square, triangular, polygonal, etc. In addition, various combinations of materials and shapes can be used for the wipers to customize the wiping capability of each section.

[0031] In Figures 6-7, three wipers are used corresponding to the sections which sit between contacts 52, 54, 56, 58. Such a configuration is offered only as an example. In the particular configuration shown the wipers sequentially wipe each portion of the pusher system 80 that is pushed through the wipers, thus minimizing the chance of fluid buildup which can degrade the electrical connection system. More or fewer wipers can be used (i.e. in the three section configuration shown, the proximal and distal end sections may utilize a wiper while the middle section does not, or just the middle and distal end section portion, or a wiper may be utilized on only one of the proximal/distal/middle sections, etc.) Fewer wipers may be utilized in a situation where highly absorbent material is used. The wiper size may also vary (i.e. filling just a portion of the section it sits in, or filling substantially all of the section if sits in). This size can vary both in height and in width. Additionally, the number of sections may vary from one to more than three, and the wipers in turn can sit within one or more sections. Additionally, more than one wiper can be used in each section.

[0032] Preferably, the wipers 70 are annular and sized to place a moderate amount of pressure on the pusher system 80 when the proximal end 81 of the pusher system 80 is inserted into pusher/grip connector 20. This friction fit ensures an efficient cleaning of the pusher system 80 as it is inserted. Additionally, the use of multiple wipers 70 further protects the inner components of the pusher/grip connector 20 from contamination.

[0033] A typical operation of the device is as follows. The user would insert a proximal end 81 of pusher system 80 into the pusher/grip connector 20 of grip system 10, as shown in Figure 6. As the proximal end of pusher system is inserted into the pusher/grip connector 20, fluid present on any section of pusher system 80 would be wiped from the pusher by wipers 70. As shown in Figure 7, when the pusher system 80 is correctly aligned
within pusher/grip connector 20, contact sections 82, 84, 86, 88 of the pusher system will
directly align with contacts 52, 54, 56, 68 of the pusher/grip connector. Connectors 32, 34,
36, 38 - which are connected respectively to contacts 52, 54, 56, 58 - will convey a signal
when the pusher contacts 82, 84, 86, 66 are aligned with pusher/grip connector contacts
52, 54, 56, 68. If the respective connectors are aligned correctly, the signal will be
conveyed through connectors 32, 34, 36, 38 via control system 30. Light 48 will
subsequently light up a particular color (i.e. green), indicating that a detachment sequence
can be initiated. To initiate the detachment sequence the user pushes button 16. Pushing
button 16 will initiate depression of back button 46 which sits behind button 16. This will
result in detachment of the embolic coils from pusher system 80 at a more distal portion of
pusher system 80. In one example, pushing button 16 initiates the heating of a heater coil
at a more distal portion of pusher system 80, where pusher system 80 is connected to an
embolic coil. This heating will result in detachment of the embolic coil from the pusher
system. Thus the embolic coil will be detached within the target area of the vasculature.

[0034] Although the invention has been described in terms of particular embodiments
and applications, one of ordinary skill in the art, in light of this teaching, can generate
additional embodiments and modifications without departing from the spirit of or exceeding
the scope of the claimed invention. Accordingly, it is to be understood that the drawings
and descriptions herein are proffered by way of example to facilitate comprehension of the
invention and should not be construed to limit the scope thereof.
We claim:

1. A grip assembly for a medical delivery system comprising:
   a housing defining at least one channel sized to receive a proximal end of a medical delivery system;
   an electrical contact contained within said at least one channel and positioned to establish an electrical connection with an electrical contact on an external surface of said medical delivery system; and,
   at least one annular wiper disposed within said housing and having a diameter smaller than a diameter of said proximal end of said medical delivery system, thereby creating an interference fit between said wiper and said medical delivery system, when said medical delivery system is inserted in said housing, that prevents dirt and/or fluid on said medical delivery system from passing by said wiper.

2. The grip assembly of claim 1 wherein said at least one channel comprises a plurality of channels.

3. The grip assembly of claim 2 wherein said plurality of channels comprises a plurality of coaxial channels.

4. The grip assembly of claim 3 wherein said at least one annular wiper comprises a plurality of annular wipers, each of said wipers placed proximate one of said plurality of coaxial channels.

5. The grip assembly of claim 4 wherein said plurality of channels and said plurality of annular wipers are coaxially arranged in an alternating configuration.

6. The grip assembly of claim 1 wherein said wipers comprise an absorbent material selected from the group consisting of paper, cloth, sponge, and polymers.
7. The grip assembly of claim 1 wherein said wipers comprise a shape selected from the group consisting of circular, ellipsoid, rectangular, square, triangular and polygonal.

8. The grip assembly of claim 1 further comprising a funnel having a narrow end that leads to said at least one channel.

9. A grip assembly for controlling an electrical medical device comprising:
   - at least one channel for receiving a proximal portion of said medical device;
   - an electrical contact for establishing an electrical connection with a corresponding electrical contact on said proximal portion of said medical device;
   - a power supply operably associated with said electrical contact for supplying said medical device with electricity; and,
   - at least one wiper coaxial with said at least one channel and having an inner diameter smaller than said at least one channel, such that when said medical device is inserted into said at least one channel, an interference fit is established between said medical device and said at least one wiper such that fluid and/or debris are prevented from entering said at least one channel.

10. The grip assembly of claim 9 wherein said at least one channel comprises a plurality of channels.

11. The grip assembly of claim 10 wherein said plurality of channels comprises a plurality of coaxial channels.

12. The grip assembly of claim 11 wherein said at least one wiper comprises a plurality of wipers, each of said wipers placed proximate one of said plurality of coaxial channels.

13. The grip assembly of claim 12 wherein said plurality of channels and said plurality of wipers are coaxially arranged in an alternating configuration.
14. The grip assembly of claim 9 wherein said wipers comprise an absorbent material selected from the group consisting of paper, cloth, sponge, and polymers.

15. The grip assembly of claim 9 wherein said wipers comprise a shape selected from the group consisting of circular, ellipsoid, rectangular, square, triangular and polygonal.

16. The grip assembly of claim 9 further comprising a funnel having a narrow end that leads to said at least one channel.

17. A method of establishing a clean electrical connection between a powered grip and a medical device inserted into said grip comprising providing at least one wiper in said grip, said wiper disposed to interfere with an electrical contact on a medical device being inserted into said grip without preventing said medical from being inserted into said grip.

18. The method of claim 17 wherein providing at least one wiper in said grip comprises providing at least one wiper that surrounds a proximal portion of said medical device when said medical device is being inserted into said grip.

19. The method of claim 17 wherein providing at least one wiper comprises providing a plurality of wipers.

20. The method of claim 19 wherein providing a plurality of wipers comprises providing a plurality of wipers axially spaced apart from each other.
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US14/19155

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8): A61M5/178, 2501, 2502, 2505, 2509, 2514, 2518 (2014.01)
USPC: 600/300, 604/164.01, 171, 524, 606/170, 185

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8): A61M 5/178, 2501, 2502, 2505, 2509, 2514, 2518 (2014.01)
USPC: 600/300, 604/164.01, 171, 524, 606/170, 185

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)


C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 20110160824 A1 (WARE, EA et al.) June 30, 2011; figures 1, 6A-B, 7-8, 13-15; paragraphs [0042], [0056]-[0067], [0069]-[0066], [0083]</td>
<td>1-20</td>
</tr>
<tr>
<td>Y</td>
<td>US 5879499 A (CORVI, TJ) March 9, 1999; figure 31; column 35, lines 20-67</td>
<td>1-16</td>
</tr>
<tr>
<td>Y</td>
<td>US 2004/0181 177 A1 (LEE, C et al.) September 16, 2004; figures 1, 3-4; paragraphs [0040], [0045]-[0047], [0076]-[0079]</td>
<td>17-20</td>
</tr>
<tr>
<td>Y</td>
<td>US 2010/0199448 A1 (VAZALES, BE et al.) August 12, 2010; figure 12; paragraphs [0171]-[0174]</td>
<td>2-5, 10-13, 19-20</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:
  'A' document defining the general state of the art which is not considered to be of particular relevance
  'E' earlier application or patent but published on or after the international filing date
  'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  'O' document referring to an oral disclosure, use, exhibition or other means
  'P' document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search: 14 May 2014 (14.05.2014)

Date of mailing of the international search report: 7 MAY 2014

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer: Shane Thomas
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)