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(54) Title: A CATHETER ELECTRICAL CONNECTOR ASSEMBLY

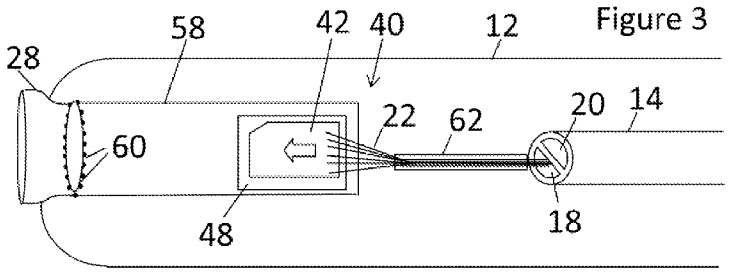

Figure 3

(57) Abstract: A catheter (10) includes a catheter sheath (14), and a handle (12). The handle includes an electrical connector (28) at its proximal end for connecting the catheter to standard electrical devices such as a typical monitoring device. The catheter handle (12) houses an electrical connector assembly (40). The electrical connector assembly (40) includes a first connector member (42) to which electrical conductors of a catheter sheath (14) are connected and a second connector member (48) which is further connected to the connector (28) integrated at the proximal end of the catheter handle (12). The first connector member (42) is received in a socket (50) of the second connector member (48) in a clip-in manner.

A CATHETER ELECTRICAL CONNECTOR ASSEMBLY

Technical Field

This disclosure relates, generally, to the field of catheters and, more particularly, to a catheter electrical connector assembly and to a catheter assembly including the electrical connector assembly.

Background Art

Any discussion of the prior art throughout the specification should in no way be considered as an admission that such prior art is widely known or forms part of common general knowledge in the field.

Catheters are becoming increasingly more complex and, as a result, more expensive. Generally, catheters are used once only and are then disposed of. This results in significant expense for the institution using the catheters. Ultimately, these expenses are passed on to the patient. This results in medical costs both for the patient and medical funds, be they private or government funds, increasing.

It would be beneficial to be able to reprocess catheters. A problem with reprocessing of catheters is that the electrical connections made between the catheter sheath and the handle are secured connections which are difficult to disconnect. The electrical connector itself at a proximal end of the handle is also an expensive item. Thus, ideally, it would be beneficial to be able to re-use the electrical connector.

To reprocess the catheters, non-skilled labour is often used. Such non-skilled labour may not have the necessary abilities to be able to disconnect the catheter sheath from the electrical connector of the handle in an efficient manner. Also, with a secure connection between the conductors of the catheter sheath and the connector, special tools may be required which are easy to misplace and, without the tools, it is not possible to effect disconnection of the catheter sheath from the handle in a re-usable manner.

Summary

It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

In a first aspect, there is provided a catheter electrical connector assembly which includes:

a first connector member to which conductors of a catheter sheath are connectable; and

a second connector member to which conductors of an electrical connector of a catheter handle are connectable, the first connector member and the second connector member having complementary engaging formations for effecting disconnection between the first connector member and the second connector member, the first and second connector members further being of a compact construction to facilitate mounting in the catheter handle.

"effecting disconnection" is to be understood to mean that the two connector members may be connected and disconnected easily e.g. in a clip-in manner from one another so that no tools are required to disconnect the connector members from each other. In addition, "compact construction" is to be understood to mean that, when the connectors, connected to each other, are mounted in the handle, there is still space in the handle for other items to pass the connected connectors. The other items may be a stylet, an irrigation conduit, or the like.

The first connector member may have a substantially planar configuration having a surface carrying conductive pads, the conductors of the catheter sheath being electrically connectable to the conductive pads.

The second connector member may comprise a receptacle defining a socket housing terminals, the first connector member being receivable in the socket, preferably slidably, with each pad of the first connector member being associated with one of the terminals of the receptacle.

The first connector member may have a configuration similar to a SIM card, compact memory card, or the like. Thus, the receptacle of the second connector member may be shaped to accommodate the card-shaped first connector member. If necessary or desired, the receptacle may comprise a retaining element, such as a clip, for retaining the first connector member in the receptacle of the second connector member with the retaining member being manipulated to effect release of the first connector member from the second connector member.

The terminals of the receptacle may be connectable via a cable arrangement to the electrical connector.

In an embodiment, the second connector member may comprise a printed circuit board on which the receptacle is mounted, the cable arrangement extending from the printed circuit board. In another embodiment, the cable arrangement may comprise a flexible printed circuit board on which the receptacle is mounted, the flexible printed circuit board being connectable to the electrical connector.

In a second aspect, there is provided a catheter electrical connector assembly which includes:

a first, card-shaped connector member to which conductors of a catheter sheath are connectable; and

a second connector member to which conductors of an electrical connector of a catheter handle are connectable, the second connector member defining a socket formation in which the first connector member is removably receivable.

In a third aspect, there is provided a catheter assembly which includes:

a handle having a proximal end and a distal end and a passage extending between the proximal end and the distal end;

an electrical connector arranged at the proximal end of the handle with the electrical connector being in communication with the passage of the handle;

a catheter sheath extending from the distal end of the handle, the catheter sheath carrying at least one electrode at a distal region of the catheter sheath with conductors for the catheter sheath extending along the catheter sheath proximally to extend beyond a proximal end of the catheter sheath; and

an electrical connector assembly, as described above, received in the passage of the handle with the conductors of the catheter sheath connected to the first connector member and the second connector member being electrically connected to the electrical connector.

The catheter sheath may define at least one lumen and the conductors extend through the lumen.

The catheter assembly may include a protective element which is received over those portions of the conductors extending beyond the proximal end of the catheter sheath.

The protective element may be a sleeve acting as a strain relief. The sleeve may be of a heat shrink material.

Brief Description of Drawings

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of an embodiment of a catheter assembly;

Figure 2 shows a schematic, sectional side view of a first embodiment of a catheter electrical connector assembly;

Figure 3 shows a schematic, sectional side view of a second embodiment of a catheter electrical connector assembly;

Figure 4 shows a schematic, perspective view of a first connector member of the assembly of Figure 2 or Figure 3; and

Figure 5 shows a plan view of an example of a second connector member of the assembly of Fig.2 or Fig. 3.

Description of Embodiments

In the drawings, reference numeral 10 generally designates an embodiment of a catheter assembly. The catheter assembly includes a handle body 12. A catheter sheath 14 extends from a distal end 16 of the handle arrangement. The catheter sheath 14 defines a plurality of lumens, illustrated schematically at 18 and 20 Figs. 2 and 3 of the drawings. The lumen 18 is a conductor lumen and has a plurality of conductors 22 received therein. The lumen 20 is a deflection stylet lumen for receiving a deflection stylet (not shown). While not illustrated, the catheter sheath 14 includes a further lumen, being an irrigation lumen. The irrigation lumen of the catheter sheath14 has a proximal end in communication with a fluid supply conduit 24 having a Luer connector 26 arranged at the proximal end of the conduit 24.

An electrical connector 28 is arranged at a proximal end 30 of the handle body 12. The catheter assembly 10 further includes deflection and size selection units 32 and 34, respectively, arranged at a distal end 36 of the handle body 12.

Referring now to Figs. 2 and 3 of the drawings, two embodiments of an electrical connector assembly 40 of the catheter assembly 10 are described in greater detail.

The purpose of the connector assembly 40 is to connect the electrical conductors that transmit electrical signals from or to the electrodes located at the distal end of the catheter sheath 14 to a patient monitor or similar via the connector unit 28. The connector assembly 40 comprises a first connector member 42 to which the conductors 22 of the catheter sheath 14 are connected. In the embodiments illustrated, the connector member 42 has a substantially planar configuration. Preferably, the connector member 42 has a configuration similar to a SIM card, a micro SD card, a compact memory card, or the like.

The first connector member 42 defines a surface 42.1 on which the conductors 22 of the catheter sheath 14 terminate in terminations 44. These terminations 44 are, in turn, connected to electrically conductive pads 46 on the surface 42.1. The conductors 22 are permanently connected to the first connector member 42 by welding or by another suitable method so that the signals transmit from the electrical conductors 22 to the conductive pads 46 of the first connector member 42.

The connector assembly 40 further includes a second connector member 48 arranged in the handle body 12. The second connector member 48 receives the first connector member 42 therein, preferably, in a slideable manner or in a clip-in manner. The second connector member 48 is therefore in the form of a receptacle which defines a socket 50 in which the planar first connector member 42 is received. The second connect member 48 has a plurality of terminals 52 within the socket 50, the terminals 52 mating with the pads 46 of the first connector member 42 when the first connector member 42 is received in the socket 50 of the second connector member 48.

In the embodiment of the electrical connector assembly 40 illustrated in Fig. 2 of the drawings, the second connector member 48 is surface mounted on a printed circuit board 54. The printed circuit board 54 is, in turn, connected via a plurality of connecting wires, in the form of a ribbon cable or soldered wires, 56 to the connector 28.

It will therefore be appreciated that, when it is desired to replace the catheter sheath 14, the first connector member 42 is disconnected from the second connector member 48 by sliding it out of the second connector member 48 or unclipping it from the second

connector member 48. Thus, no special tools are required to disconnect the first connector member 42 from the second connector member 48. The sub-assembly comprising the second connector member 48, the circuit board 54 and the connector 28 remain in the handle body 12 for reprocessing and re-use.

In the embodiment of the electrical connector assembly shown in Fig. 3 of the drawings, the second connector member 48 is mounted on a flexible printed circuit board 58 which, in turn, is directly connected to pins 60 of the electrical connector 28.

In this embodiment, once again, to remove the catheter sheath 14 from the catheter assembly 10, the first connector member 42 is disconnected from the second connector member 48 by sliding the first connector member 42 out of the second connector member 48 or unclipping the first connector member 42 from the second connector member 48. Thus, once again, no special tools are required to disconnect the first connector member 42 from the second connector member 48.

Likewise, no special tools are required, in either embodiment, to re-connect the first connector member 42 and the second connector member 48.

In both embodiments, to protect those portions of the conductors 22 of the catheter sheath 14 projecting proximally from the proximal end of the catheter sheath 14, a protective heat shrink sleeve 62 is applied to the conductors 22. This also serves to retain the conductors 22 in a neat bundle and allows more space within the interior of the handle body 40. The sleeve 63 further functions as a strain relief.

It is a particular advantage of the disclosed embodiments that a connector assembly is provided which facilitates ease of disconnection of the catheter sheath 14 from the handle body 12 of the catheter assembly 10. In addition, the electrical connector assembly 40, being substantially planar, is of a compact construction rendering the interior of the handle body 12 free of obstructions and allowing ancillary items, such as a deflection stylet (not shown) and the irrigation conduit 24, to pass through the interior of the handle body 12 easily.

In addition, the ease of disconnection of the first connector member 42 from the second connector member 48 of the electrical connector assembly 40 readily lends the catheter assembly 10 for re-processing purposes. Thus, costs involved with doing cardiac

procedures using such catheters can be significantly reduced due to the ability to re-use the catheters after reprocessing. In this regards, the term "reprocessing" (and derivatives) is to be understood in a broad sense to include reprocessing, remanufacturing, refurbishment, or the like.

Reference throughout this specification to "one embodiment", "some embodiments" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment", "in some embodiments" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinarily skill in the art from this disclosure, in one or more embodiments.

As used herein, unless otherwise specified the use of ordinal adjectives "first", "second", "third", etc., to describe a common object, merely indicate that different instances of like objects are referred to, and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

In the claims below and the description herein, any one of the terms comprising, comprised of or which comprises is an open term that means including at least the elements/features that follow, but not excluding others. Thus, the term comprising, when used in the claims, should not be interpreted as being limitative to the means or elements or steps listed thereafter. For example, the scope of the expression a device comprising A and B should not be limited to devices consisting only of elements A and B. Any one of the terms including or which includes or that includes as used herein is also an open term that also means including at least the elements/features that follow the term, but not excluding others. Thus, including is synonymous with and means comprising.

It should be appreciated that in the above description of exemplary embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, FIG., or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the

claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less that all features of a single foregoing disclosed embodiment. Thus the claims following the Detailed Description are hereby expressly incorporate into this Detailed Description, with each claim standing on its own as a separate embodiment of this invention.

Furthermore, while some embodiments described herein include some but not other features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those skilled in the art. For example, in the following claims, any of the claimed embodiments can be used in any combination.

In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

Similarly, it is to be noticed that the term coupled, when used in the claims, should not be interpreted as being limited to direct connections only. The terms "coupled" and "connected", along with their derivatives, may be used. It should be understood that these terms are not intended as synonyms for each other. Thus the scope of the expression a device A coupled to a device B should not be limited to devices or systems wherein an output of device is directly connected to an input of device B. It means that there exists a path between an output of A and an input of B which may be a path including other devices or means. "Coupled" may mean that two or more elements are either in direct physical or electrical contact, or that two or more elements are not in direct contact with each other but yet still co-operate or interact with each other.

Thus, while there has been described what are believed to be the preferred embodiments of the invention, those skilled in the art will recognize that other and further modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such changes and modifications as falling within the scope of the invention. For example, any formulas given above are merely representative of procedures that may be used. Functionality may be added or deleted from the block

diagrams and operations may be interchanged among functional blocks. Steps may be added or deleted to methods described within the scope of the invention.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the disclosure as shown in the specific embodiments without departing from the scope of the disclosure as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A catheter electrical connector assembly which includes:

a first connector member to which conductors of a catheter sheath are connectable; and

a second connector member to which conductors of an electrical connector of a catheter handle are connectable, the first connector member and the second connector member having complementary engaging formations for effecting disconnection between the first connector member and the second connector member, the first and second connector members further being of a compact construction to facilitate mounting in the catheter handle.

2. The assembly of claim 1 in which the first connector member has a substantially planar configuration having a surface carrying conductive pads, the conductors of the catheter sheath being electrically connectable to the conductive pads.

3. The assembly of claim 2 in which the second connector member comprises a receptacle defining a socket housing terminals, the first connector member being receivable in the socket with each pad of the first connector member being associated with one of the terminals of the receptacle.

4. The assembly of claim 3 in which the terminals of the receptacle are connectable via a cable arrangement to the electrical connector of the catheter handle.

5. The assembly of claim 4 in which the second connector member comprises a printed circuit board on which the receptacle is mounted, the cable arrangement extending from the printed circuit board.

6. The assembly of claim 4 in which the cable arrangement comprises a flexible printed circuit board on which the receptacle is mounted, the flexible printed circuit board being connectable to the electrical connector of the catheter handle.

7. A catheter electrical connector assembly which includes:

a first, card-shaped connector member to which conductors of a catheter sheath are connectable; and

a second connector member to which conductors of an electrical connector of a catheter handle are connectable, the second connector member defining a socket formation in which the first connector member is removably receivable.

8. A catheter assembly which includes:

a handle having a proximal end and a distal end and a passage extending between the proximal end and the distal end;

an electrical connector arranged at the proximal end of the handle with the electrical connector being in communication with the passage of the handle;

a catheter sheath extending from the distal end of the handle, the catheter sheath carrying at least one electrode at a distal region of the catheter sheath with conductors for the catheter sheath extending along the catheter sheath proximally to extend beyond a proximal end of the catheter sheath; and

an electrical connector assembly, as claimed in any one of the preceding claims, received in the passage of the handle with the conductors of the catheter sheath connected to the first connector member and the second connector member being electrically connected to the electrical connector.

9. The catheter assembly of claim 8 in which the catheter sheath defines at least one lumen and the conductors extend through the lumen.

10. The catheter assembly of claim 8 or claim 9 which includes a protective element which is received over those portions of the conductors extending beyond the proximal end of the catheter sheath.

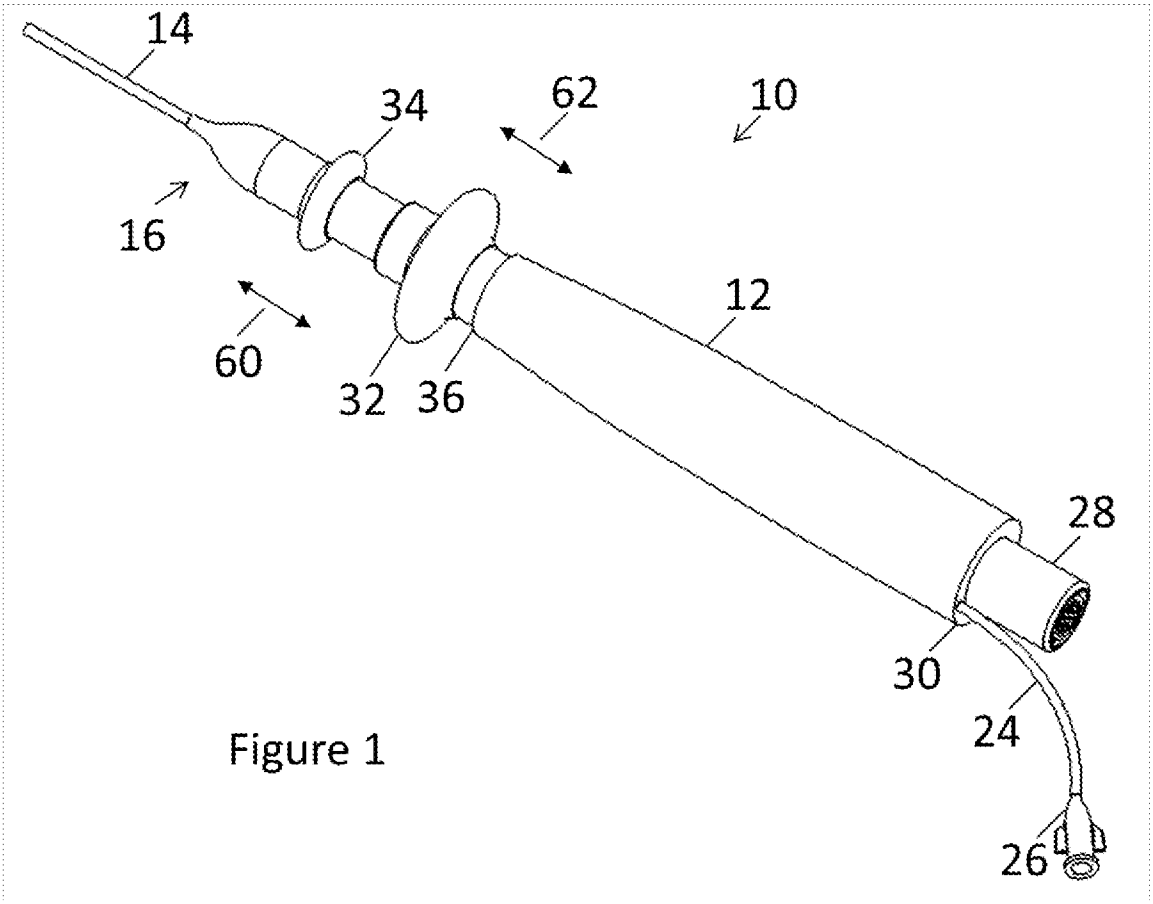

Figure 1

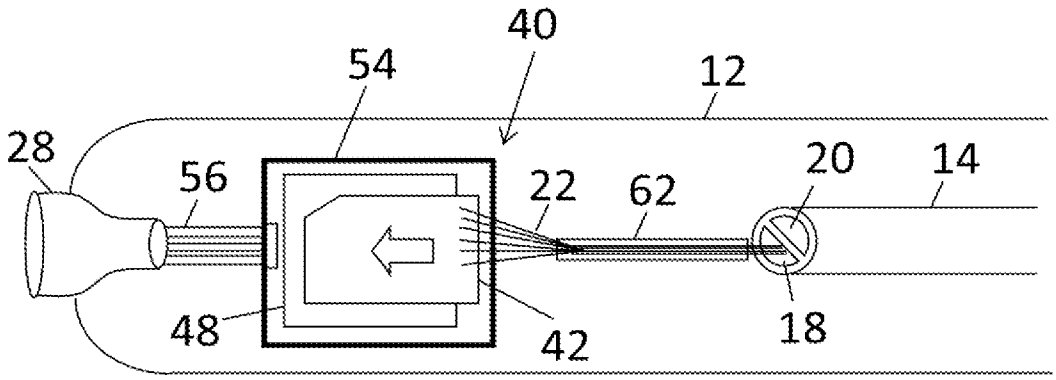

Figure 2

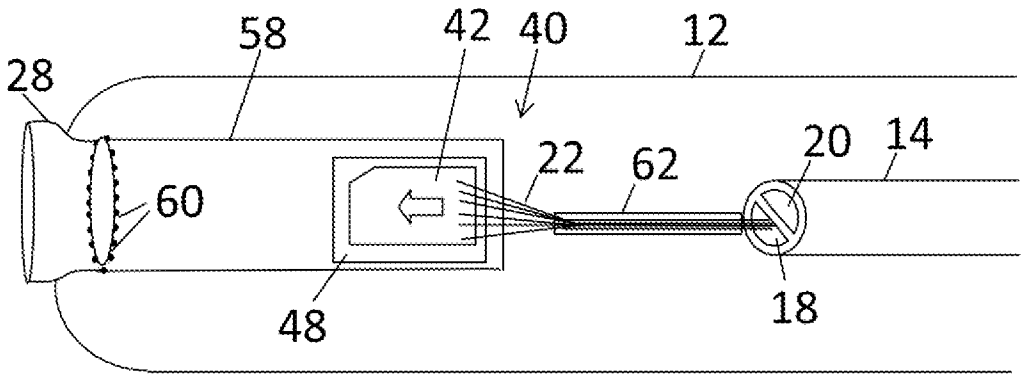

Figure 3

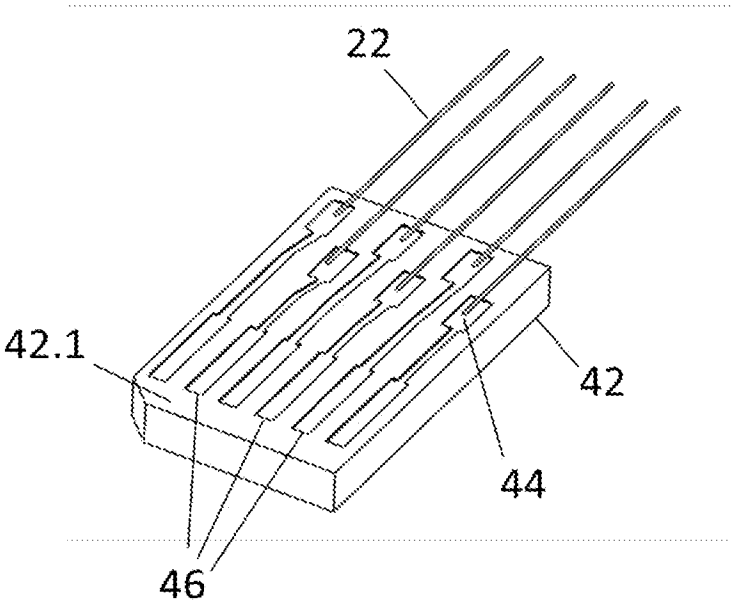

Figure 4

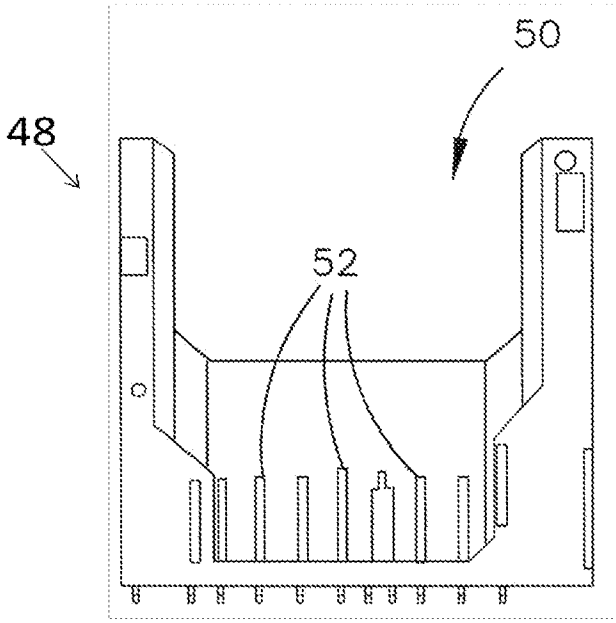

Figure 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/001020

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A61B 18/00 (2006.01), ***A61B 17/00*** (2006.01), ***A61M 25/00*** (2006.01)

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)

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)
WPI, EPODOC: IPC A61B 17/-, A61B 18/-, A61B 19/-, A61M 25/-, H01R 12/-, H01R 13/-; EC H01R 13/52R; Keywords (catheter, electric+, connect+, handle, passage) and like terms.
GOOGLE & GOOGLE SCHOLAR Internet searches; Keywords (catheter, connector, card, printed, circuit) and like terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0195081 A1 (LANDIS et al.) 31 August 2006 Figure 4; Paragraph 0072; Claims 1, 5	1-10
X	US 2009/0157091 A1 (BUYSMAN) 18 June 2009 Figure 23; Paragraphs 0010, 0013, 0093	1, 8-10
X	WO 2008/045869 A2 (BIOSENSE WEBSTER, INC.) 17 April 2008 Figure 4; Paragraph 0025	1, 8-10
X	US 2003/0097129 A1 (DAVISON et al.) 22 May 2003 Figures 19, 20; Paragraph 0229	1, 8-10

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
9 September 2011	12/09/2011
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **JOHN SCHWEITZER** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2400

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/001020

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6099354 A (TROYAN) 8 August 2000 Figures 1-4, 10; Column 3, lines 15-21; Column 5, line 32 to column 6, line 11	7
A	US 4684245 A (GOLDRING) 4 August 1987 Abstract, figures	7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2011/001020

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
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US	4684245	EP	0221357	JP	62102736		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX