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(71) Applicant: **Biosense Webster, Inc.**
Diamond Bar, CA 91765 (US)

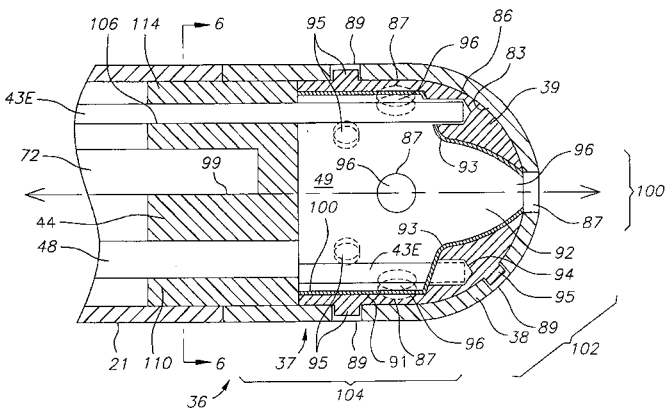
(72) Inventors:
- **Lee, James K.**
  West Covina, CA 91791 (US)
- **Lieber, Chad Allen**
  Chino Hills, CA 91709 (US)
- **Zirkle, Michael Olen**
  Fullerton, CA 92835 (US)

(74) Representative: **Small, Gary James et al**
Carpmaels & Ransford
43-45 Bloomsbury Square
London WC1A 2RA (GB)

(54) Catheter with omni-directional optical tip having isolated optical paths

(57) A catheter enables real-time light measurements, for example, without limitation, diffuse reflectance, fluorescence, etc., from biological materials, such as tissue (including blood), while performing RF ablation. The catheter tip design isolates illumination and collection paths such that light exits the catheter tip and travels through the tissue of interest (e.g., cardiac tissue or blood) before returning to the catheter tip. Such a design advantageously avoids saturation of the optical detector, and ensures diffusion of the illumination light within the medium of interest. The catheter has a catheter body and a tip electrode. The tip electrode has an exterior shell, an inner layer of diffuse material and a hollow cavity, wherein the inner layer is configured to transmit light outside the tip electrode to a tissue via a set of illumination openings in the shell wall and the hollow cavity is configured to receive light from the tissue via a set of collection openings in the shell wall and the inner layer. An inner surface of the inner layer has an opaque coating to isolate light injected into the inner layer from light collected in the hollow cavity. There are a first optical waveguide extending between the catheter body and the tip electrode to inject light into the inner layer and illuminate the tissue, and a second optical waveguide extending between the catheter body and the tip electrode to collect the recaptured light in the hollow cavity.

FIG. 4A



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EUROPEAN SEARCH REPORT

Application Number
EP 08 25 3725

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 195 375 A (MASSACHUSETTS INST TECHNOLOGY [US]) 24 September 1986 (1986-09-24) * the whole document *	1-9	INV. A61B18/14 A61B5/00 ADD. A61B17/00
P,X	US 2008/119694 A1 (LEE JAMES K [US]) 22 May 2008 (2008-05-22) * abstract; figures 1,4A-B,11A-C,13 * * paragraphs [0040], [0041], [0043] - [0058], [0062] - [0064], [0070], [0071], [0078], [0079] *	1-9	
A	US 2003/040657 A1 (YAMAYA KOJI [JP] ET AL) 27 February 2003 (2003-02-27) * the whole document *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

A61B

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	14 April 2009	Molina Silvestre, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-9

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 08 25 3725

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-9

   An ablation catheter with an improved optical tissue measurement system having separate illumination and light collection paths.

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2. claims: 10-29

   An ablation catheter with a tip electrode having a particular physical structure (but not necessarily separate optical paths).

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 25 3725

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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14-04-2009

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

专利名称(译)	具有全向光学尖端的导管具有隔离的光学路径		
公开(公告)号	EP2062545A3	公开(公告)日	2009-08-12
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[标]申请(专利权)人(译)	韦伯斯特生物官能公司		
申请(专利权)人(译)	生物传感韦伯斯特，INC.		
当前申请(专利权)人(译)	生物传感韦伯斯特，INC.		
[标]发明人	LEE JAMES K LIEBER CHAD ALLEN ZIRKLE MICHAEL OLEN		
发明人	LEE, JAMES K. LIEBER, CHAD ALLEN ZIRKLE, MICHAEL OLEN		
IPC分类号	A61B18/14 A61B5/00 A61B17/00		
CPC分类号	A61B5/0084 A61B18/1492 A61B2018/00815 A61B2018/00821 A61B2018/00982 A61B2034/2051 A61B2090/3614 A61B2218/002		
优先权	11/941884 2007-11-16 US		
其他公开文献	EP2062545A2 EP2062545B1		
外部链接	Espacenet		

摘要(译)

导管能够进行实时光测量，例如但不限于漫反射，荧光等，来自生物材料，例如组织（包括血液），同时进行RF消融。导管尖端设计隔离照明和收集路径，使得光在返回导管尖端之前离开导管尖端并穿过感兴趣的组织（例如，心脏组织或血液）。这种设计有利地避免了光学检测器的饱和，并确保了照明光在感兴趣的介质内的扩散。导管具有导管主体和尖端电极。尖端电极具有外壳，内层漫射材料和中空腔，其中内层配置成通过壳壁中的一组照射开口将尖端电极外部的光传输到组织，并且中空腔是配置成通过壳壁和内层中的一组收集开口从组织接收光。内层的内表面具有不透明涂层，以将注入内层的光与收集在空腔中的光隔离。在导管主体和尖端电极之间延伸的第一光学波导将光注入内层并照射组织，第二光学波导在导管主体和尖端电极之间延伸，以收集空心腔中的重新捕获的光。

FIG. 4A