

(51) International Patent Classification:
A61B 8/12 (2006.01)(21) International Application Number:
PCT/US2011/060203(22) International Filing Date:
10 November 2011 (10.11.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/412,674 11 November 2010 (11.11.2010) US
61/509,866 20 July 2011 (20.07.2011) US(71) Applicant (for all designated States except US): **COVIDI-
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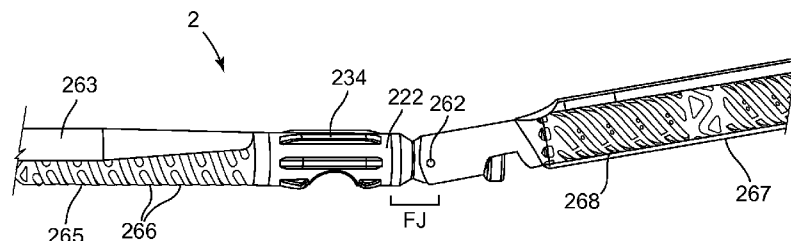
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Minnesota 55042 (US).(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(88) Date of publication of the international search report:
3 January 2013

(54) Title: FLEXIBLE DEBULKING CATHETERS WITH IMAGING AND METHODS OF USE AND MANUFACTURE

**FIG. 16A**

(57) Abstract: Catheters and methods for removing material from a body lumen while imaging the region comprised of the material are provided. The catheters can be used in body lumens, including but not limited to intravascular lumens such as coronary or peripheral arteries. The catheters include housings (122) or other structures to mount or protect an imaging transducer (40). Generally, debulking catheters include a proximal portion, a distal portion having an opening, a cutting element (4) which may be exposed through the opening to contact material in a body lumen and an imaging transducer with associated circuitry and display. The catheter debulks a body lumen when it is moved while the cutting element is in contact with the material in the lumen and the region comprised of the material is imaged before, after, or during catheter movement.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/060203

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B8/12

ADD.

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)

A61B

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/167824 A1 (LEE WARREN [US] ET AL) 19 July 2007 (2007-07-19) paragraph [0120]; figures 14c,14h -----	1-32
X	US 2008/097403 A1 (DONALDSON BRENDA L [US] ET AL) 24 April 2008 (2008-04-24) figures 2,3 paragraph [0017] -----	1
X	US 5 799 655 A (JANG YUE-TEH [US] ET AL) 1 September 1998 (1998-09-01) sentence 6 - sentence 20; figure 2 -----	1
X	WO 93/16642 A1 (BOSTON SCIENT CORP [US]) 2 September 1993 (1993-09-02) figures 2,2a page 13, line 22 - line 31 -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* 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

7 May 2012

Date of mailing of the international search report

30/07/2012

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/060203

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-32

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2011/060203

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007167824	A1	19-07-2007	NONE
US 2008097403	A1	24-04-2008	NONE
US 5799655	A	01-09-1998	CA 2146363 A1 14-04-1994 EP 0668743 A1 30-08-1995 JP 3571338 B2 29-09-2004 JP H08508895 A 24-09-1996 US 5383460 A 24-01-1995 US 5570693 A 05-11-1996 US 5634464 A 03-06-1997 US 5799655 A 01-09-1998 WO 9407418 A1 14-04-1994
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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-32

Ultrasound catheter with a distal housing that comprises three different materials. This group of claims is directed towards solving the technical problem how to improve flexibility of the catheter and at the same time protect the transducer.

2. claims: 33-40

Ultrasound catheter with a transducer within a lumen. A hydrophilic material fills the gap between lumen and transducer. This group of claims is directed towards solving the problem how to improve ultrasound transmission into the body.

3. claims: 41-43

Ultrasound catheter having an ultrasound transducer and a lumen. A gap is provided between transducer and catheter. This group of claims is directed towards solving the technical problem how to arrange the transducer in the lumen.
