



- (51) International Patent Classification:  
A61M 25/088 (2006.01) A61M 25/09 (2006.01)  
A61F 2/24 (2006.01)
- (21) International Application Number:  
PCT/US2012/040481
- (22) International Filing Date:  
1 June 2012 (01.06.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
61/492,279 1 June 2011 (01.06.2011) US  
13/397,545 15 February 2012 (15.02.2012) US
- (71) Applicant (for all designated States except US): MICARDIA CORPORATION [US/US]; 30 Hughes, Suite 206, Irvine, California 92618 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): BUCHBINDER, Maurice [US/US]; 8501 La Jolla Scenic Drive, La Jolla,

California 92037 (US). SHAOLIAN, Samuel M. [US/US]; 2315 Arbutus Street, Newport Beach, California 92660 (US).

(74) Agent: BARKER, Aaron D.; Stoel Rives LLP, 201 So. Main Street, Suite 1100, Salt Lake City, Utah 84111 (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, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

[Continued on next page]

(54) Title: PERCUTANEOUS TRANSCATHETER REPAIR OF HEART VALVES VIA TRANS-APICAL ACCESS

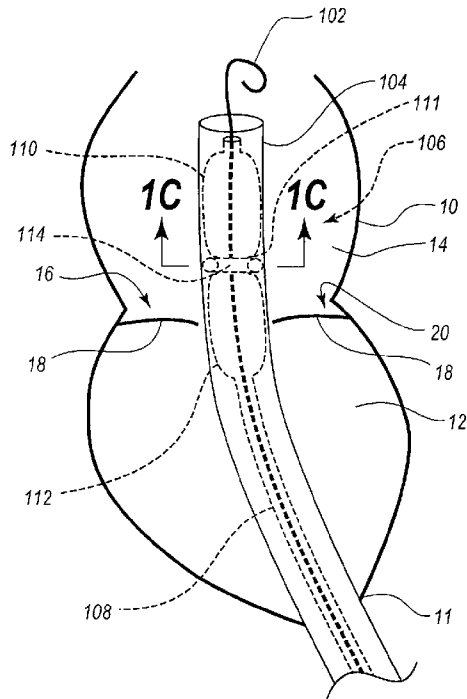
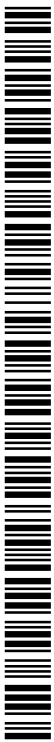


FIG. 1B

(57) Abstract: Apparatus, systems, and methods are provided for repairing heart valves through percutaneous transcatheter delivery and fixation of annuloplasty rings to heart valves via a trans-apical approach to accessing the heart. A guiding sheath may be introduced into a ventricle of the heart through an access site at an apex of the heart. A distal end of the guiding sheath can be positioned retrograde through the target valve. An annuloplasty ring arranged in a compressed delivery geometry is advanced through the guiding sheath and into a distal portion of the guiding sheath positioned within the atrium of the heart. The distal end of the guiding sheath is retracted, thereby exposing the annuloplasty ring. The annuloplasty ring may be expanded from the delivery geometry to an operable geometry. Anchors on the annuloplasty ring may be deployed to press into and engage tissue of the annulus of the target valve.





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).

— *before the expiration of the time limit for amending the  
claims and to be republished in the event of receipt of  
amendments (Rule 48.2(h))*

**Published:**

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

**(88) Date of publication of the international search report:**

24 January 2013

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2012/040481****A. CLASSIFICATION OF SUBJECT MATTER***A61M 25/088(2006.01)i, A61F 2/24(2006.01)i, A61M 25/09(2006.01)i*

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)

A61M 25/088; A61F 2/24; A61B 19/00; A61B 17/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: annuloplasty ring, catheter

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004-0148021 A1 (CARTLEDGE et al.) 29 July 2004 See claims 1-2; paragraphs [0067]-[0071],[0079],[0099]; and figs. 12 and 15-16.	15
A		16-23
Y	US 2005-0240200 A1 (BERGHEIM) 27 October 2005 See paragraphs [0036],[0040],[0042],[0044],[0047]-[0049]; and figs. 7 and 9.	15
A	US 2010-0121433 A1 (BOLLING et al.) 13 May 2010 See claim 33; paragraphs [0101]-[0102],[0104],[0106]; and figs. 8A and 8F.	15-23
A	US 2007-0051377 A1 (DUCK et al.) 08 March 2007 See paragraphs [0033],[0035],[0038],[0044]; and figs. 2-3.	15-23
PX	US 2012-0123531 A1 (TSUKASHIMA et al.) 17 May 2012 See all documents	15, 19-22

 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 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

04 DECEMBER 2012 (04.12.2012)

Date of mailing of the international search report

**06 DECEMBER 2012 (06.12.2012)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan  
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, Cheol Soo

Telephone No. 82-42-481-8525



**INTERNATIONAL SEARCH REPORT**

International application No.

**PCT/US2012/040481****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.: 1-14  
because they relate to subject matter not required to be searched by this Authority, namely:  
Claims 1-14 pertain to methods for treatment of human by therapy, and thus relate to a subject matter which this International Searching Authority is not required to search under Article 17(2)(a)(i) of the PCT and Rule 39.1(iv) of the Regulations under the PCT.
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:

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 fee, this Authority did not invite payment of any additional fee.
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.:

**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/US2012/040481**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date		
US 2004-0148021 A1	29.07.2004	AU 2003-265850 A1	19.03.2004		
		AU 2003-265852 A1	19.03.2004		
		AU 2010-206658 A1	29.07.2010		
		CA 2497042 A1	11.03.2004		
		CN 1684644 A	19.10.2005		
		CN 1684644 B	13.04.2011		
		CN 1684644 C0	19.10.2005		
		DE 60332117 D1	27.05.2010		
		EP 1531762 A2	25.05.2005		
		EP 1531762 B1	14.04.2010		
		EP 2191792 A1	02.06.2010		
		ES 2349952 T3	13.01.2011		
		JP 2005-537067 A	08.12.2005		
		JP 2012-515625 A	12.07.2012		
		JP 4316503 B2	19.08.2009		
		KR 10-1050626 B1	19.07.2011		
		RU 2005108673 A	20.01.2006		
		US 2004-249453 A1	09.12.2004		
		US 2005-149114 A1	07.07.2005		
		US 2007-0299543 A1	27.12.2007		
		US 2008-0027483 A1	31.01.2008		
		US 2008-109076 A1	08.05.2008		
		US 2009-0125102 A1	14.05.2009		
		US 2011-0009956 A1	13.01.2011		
		US 7175660 B2	13.02.2007		
		US 7297150 B2	20.11.2007		
		US 7455690 B2	25.11.2008		
		WO 2004-019816 A2	11.03.2004		
		WO 2004-019816 A3	26.08.2004		
		WO 2004-019826 A1	11.03.2004		
		WO 2010-085659 A1	29.07.2010		
		US 2005-0240200 A1	27.10.2005	AU 2005-237510 A1	10.11.2005
				AU 2005-237510 B2	08.10.2009
AU 2005-285147 A1	23.03.2006				
AU 2005-285147 B2	25.06.2009				
AU 2006-262268 A1	04.01.2007				
AU 2006-262268 B2	07.01.2010				
BR PI0510108 A	25.09.2007				
CA 2545874 A1	26.05.2005				
CA 2545874 C	21.02.2012				
CA 2579849 A1	23.03.2006				
CA 2579849 C	15.11.2011				
CA 2613461 A1	04.01.2007				
CN 102481189 A	30.05.2012				
CN 1993090 A	04.07.2007				
CN 1993090 C0	04.07.2007				
EP 1684671 A1	02.08.2006				
EP 1755459 A2	28.02.2007				

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

**PCT/US2012/040481**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		EP 1827256 A2	05.09.2007
		EP 1895944 A2	12.03.2008
		EP 2040645 A1	01.04.2009
		EP 2437688 A1	11.04.2012
		JP 2007-534382 A	29.11.2007
		JP 2010-042280 A	25.02.2010
		JP 4755176 B2	24.08.2011
		US 2005-0075584 A1	07.04.2005
		US 2005-0075712 A1	07.04.2005
		US 2005-0075713 A1	07.04.2005
		US 2005-0075717 A1	07.04.2005
		US 2005-0075718 A1	07.04.2005
		US 2005-0075719 A1	07.04.2005
		US 2005-0075720 A1	07.04.2005
		US 2005-0075724 A1	07.04.2005
		US 2005-0075726 A1	07.04.2005
		US 2005-0075728 A1	07.04.2005
		US 2005-0075729 A1	07.04.2005
		US 2005-0075730 A1	07.04.2005
		US 2005-0075731 A1	07.04.2005
		US 2005-0096738 A1	05.05.2005
		US 2005-0119688 A1	02.06.2005
		US 2006-0259137 A1	16.11.2006
		US 2006-0287718 A1	21.12.2006
		US 2010-0036474 A1	11.02.2010
		US 2010-0100176 A1	22.04.2010
		US 2011-0137408 A1	09.06.2011
		US 7044966 B2	16.05.2006
		US 7101396 B2	05.09.2006
		US 7604650 B2	20.10.2009
		US 7842084 B2	30.11.2010
		WO 2005-046528 A1	26.05.2005
		WO 2005-104957 A2	10.11.2005
		WO 2005-104957 A3	01.03.2007
		WO 2005-104957 A3	10.11.2005
		WO 2006-031648 A2	23.03.2006
		WO 2006-031648 A3	23.03.2006
		WO 2007-002166 A2	04.01.2007
		WO 2007-002166 A3	04.01.2007
		WO 2008-010817 A1	24.01.2008
		WO 2010-141047 A1	09.12.2010
US 2010-0121433 A1	13.05.2010	AU 2010-226495 A1	23.09.2010
		CA 2756028 A1	23.09.2010
		CN 102438552 A	02.05.2012
		EP 2106248 A2	07.10.2009
		EP 2408400 A1	25.01.2012
		EP 2412316 A2	01.02.2012
		JP 2010-515488 A	13.05.2010
		JP 2012-521222 A	13.09.2012

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/040481**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2008-0167713 A1	10.07.2008
		US 2009-0182419 A1	16.07.2009
		US 2010-0249920 A1	30.09.2010
		WO 2008-086172 A2	17.07.2008
		WO 2008-086172 A3	17.07.2008
		WO 2010-108079 A1	23.09.2010
		WO 2011-153408 A1	08.12.2011
US 2007-0051377 A1	08.03.2007	EP 1689329 A2	16.08.2006
		JP 2007-510525 A	26.04.2007
		US 7655040 B2	02.02.2010
		WO 2005-046488 A2	26.05.2005
		WO 2005-046488 A3	24.11.2005
US 2012-0123531 A1	17.05.2012	None	