(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 October 2014 (30.10.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/176332 A1

(51) International Patent Classification:
A61B 17/22 (2006.01) *A61L 29/04* (2006.01)
A61M 25/01 (2006.01) *A61L 29/02* (2006.01)

(21) International Application Number:
PCT/US2014/035142

(22) International Filing Date:
23 April 2014 (23.04.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/815,160 23 April 2013 (23.04.2013) US

(71) Applicant: **GMEDIX, INC.** [US/US]; 3050 Ranchview Lane North, Plymouth, Minnesota 55447 (US).

(72) Inventors: **WELCH, Jeffrey M.**; 8723 Comstock Lane North, Maple Grove, Minnesota 55311 (US). **GANSKE, Karl V.**; 985 Woodhill Court, Hopkins, Minnesota 55343 (US). **SUTTON, Gregg Stuart**; 16917 73rd Place North, Maple Grove, Minnesota 55311 (US).

(74) Agent: **PAULY, Daniel M.**; PAULY, DEVRIES SMITH & DEFFNER, LLC, 121 South 8th Street, TCF Tower, Suite 900, Minneapolis, Minnesota 55402 (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, BN, 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, IR, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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, 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, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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

— *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))*

(54) Title: THROMBUS EXTRACTION CATHETER

FIG. 1

(57) Abstract: Embodiments of the invention include a multi-lumen catheter for extracting or aspirating a blood clot or thrombus from arterial or veinous sites. Other embodiments are also included herein.

WO 2014/176332 A1

THROMBUS EXTRACTION CATHETER

This application is being filed as a PCT International Patent application on April 23, 2014 in the name of GMedix, Inc., a U.S. national corporation, applicant for the designation of all countries and Jeffrey M. Welch, a U.S. Citizen, Karl V. Ganske, a U.S. Citizen, and Gregg Stuart Sutton, a U.S. Citizen, inventors only for the designation of all countries, and claims priority to U.S. Provisional Patent Application No. 61/815,160, filed April 23, 2013, the contents of which are herein incorporated by reference in their entirety.

Field of the Invention

The present invention relates to multi-lumen catheter for extracting or aspirating blood clot or thrombus from arterial or veinous sites.

Background

In coronary and peripheral interventions requiring revascularization, many times a clot has formed proximal to the atherosclerotic lesion. Extraction of the clot prior to angioplasty or stenting can be preferred to reduce the possibility of distal emboli.

Systems available to physicians, including distal protection filters and mechanical clot maceration devices, are subject to limitations including difficult placement and manipulation, time to prepare and deliver devices, required occlusion of blood flow, and other complications such as arterial spasm and dissection. These devices in general are over-complicated and bring additional risks to the procedure. In addition, problems associated with the currently available thrombus extraction catheters include; kinking, buckling, stretching and ovaling. These problems all reduce the ability to quickly extract thrombus or navigate to the treatment site. The device of this invention solves these limitations by providing a means to quickly and directly remove the thrombus burden present in arterial and veinous interventions while maintaining the device mechanical integrity.

Summary of the Invention

Embodiments of the invention include a two lumen catheter for use in arterial or veinous interventional procedures for extracting thrombus or a clot. The catheter can comprise a first main lumen for sucking or aspirating the blood clot. The first main lumen extends from the distal tip to the proximal end. The distal portion of the first main lumen can comprise metaland can be constructed from a swaged, tightly spaced metal coil, such that the individual coil wire cross-section are substantially rectangular in shape. A proximal portion of the first lumen can comprise metal tubing and be attached to the distal portion. The proximal portion can terminate at its proximal end with a luer adapter.

A second guidewire passing lumen extending from the distal tip and exiting or terminating at a point proximal of the distal tip at a distance of 1cm to 50cm. The guidewire lumen can be attached adjacent to the outside wall of the first, main lumen.

A distal tip structure attached to the distal portion of the first main lumen is angled at its distal end 30-60 degrees from the central axis of the lumen. The distal tip can be attached by metal fusion to the distal coil portion. The distal tip can be externally coated with gold plating for enhanced radiopactiy.

This summary is an overview of some of the teachings of the present application and is not intended to be an exclusive or exhaustive treatment of the present subject matter. Further details are found in the detailed description and appended claims. Other aspects will be apparent to persons skilled in the art upon reading and understanding the following detailed description and viewing the drawings that form a part thereof, each of which is not to be taken in a limiting sense. The scope of the present invention is defined by the appended claims and their legal equivalents.

Brief Description of the Figures

The invention may be more completely understood in connection with the following drawings, in which:

FIG. 1 is a perspective view of the device.

FIG. 2 is a section view of the device showing its parts

FIG. 3 is a perspective view of the device with further distal tip embodiment

FIG. 4 is a section view of a portion of the wall of the first lumen

While the invention is susceptible to various modifications and alternative forms, specifics thereof have been shown by way of example and drawings, and will be described in detail. It should be understood, however, that the invention is not limited to the particular embodiments described. On the contrary, the intention is to cover modifications, equivalents, and alternatives falling within the spirit and scope of the invention.

Detailed Description of the Invention

The embodiments of the present invention described herein are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art can appreciate and understand the principles and practices of the present invention.

All publications and patents mentioned herein are hereby incorporated by reference. The publications and patents disclosed herein are provided solely for their disclosure. Nothing herein is to be construed as an admission that the inventors are not entitled to antedate any publication and/or patent, including any publication and/or patent cited herein.

The catheter device of this invention is a two-lumen catheter that is manipulated or navigated to the arterial or veinous site where thrombus is present. One of the lumens in the catheter of this invention is for railing over a guidewire (for example an 0.014") that is typically used to access the arterial or veinous site or branch. The catheter can be railed over a guidewire and inserted within an interventional guide catheter. The second lumen of the catheter is used mainly for sucking or aspirating the thrombus/clot. This is accomplished by attaching a large capacity syringe to the proximal second lumen luer adapter and pulling a vacuum on the syringe so as to cause suction at the distal tip of the catheter. In one embodiment, the distal tip of the catheter of this invention has a guard strut protecting the distal tip opening from being sucked against the arterial or veinous wall. In another embodiment, the distal tip is slightly angled to provide maximum cross-sectional opening at the tip.

The device of this invention can solve the problems associated with current guide catheter technology by providing a novel design, construction and materials. The thrombus catheter design of this invention can comprise a composite built tube

that is fabricated using a specially wound metal inner layer and jacketed with very thin layers of polymer inside and out. The metallic inner layer can be made using a multi-filar, such as 6-20 filars, helically wound wire structure. In an embodiment, the multi-filar helically wound wire structure can include stainless steel. In an embodiment of this invention, the helical structure can be swaged such that each individual wire strand in partially rectangular in cross-section and can result in a tightly spaced, close fitting, or intimate wire matrix. In an embodiment, the catheter can be made using a non-swaged, round, circular, oval, elliptical, square or rectangular wire. In an embodiment, the multi-filar structure wires can be coated with PTFE, such as prior to forming the multi-filar configuration. In an embodiment, the typical wall thickness of the inner metal structure can be at least 1.5 thousandths of an inch think and no more than 10 thousandths of an inch thick. In an embodiment, the mulit-filar layer can have welded terminations.

The helically wound metal structure can provide a significant improvement in mechanical integrity of the catheter tube compared to current catheters with respect to kinking, buckling, flexibility, radial strength, and maintaining circularity of the catheter lumen cross-section. This marked improvement can be achieved by the significant increase in the amount of metal in the catheter. For instance, current interventional catheters that are composite built or wire braid reinforced have total cross-sectional metallic component in the range of 5-10 %. The catheter can have a total cross-sectional metallic component of 35-65%. The transmission of mechanical energy through this significantly higher modulus composite can result in significantly higher performance.

The thrombus extraction catheter can also comprise outer and inner polymer layers or jacket made of various polymers, such as nylon, PTFE, Pebax, Polyurethane, a hydrophilic polymer, or other similar polymers. The inner polymer layer can be disposed on the inside surface of the catheter, such as the surface defining a lumen. The outer polymer layer can be disposed on the outside surface of the catheter, such as the surface that is external to a lumen. In an embodiment, the outer or inner polymer layers can include a composite of two or more polymers, such as a composite of PTFE and Pebax. In an embodiment, the outer and inner polymer layers can include different materials, such as the inner layer including PTFE and the outer layer including Pebax. In an embodiment, the outer or inner polymer layer can include two or more layers, such as the outer polymer layer including two layer of Pebax. The

polymer layers can be attached to the metal structure, such as by thermal polymer heat-shrinking or reflow. The polymer layers can be heat schrinkable, such as to allow it to be formed tightly only the helical multi-filar structure. The resultant wall thickness of the polymer layers can be between 1.0-3.0 thousandths of an inch for each layer.

The construction and performance of the thrombus extraction catheter makes it ideally suited for interventional cases where significant vascular tortuosity is encountered such as using a radial artery access or using a femoral approach on an obese patient.

The guide catheter can also comprise an angled, soft (low durometer) polymer distal tip, a radiopaque distal marker band, and a proximal luer adapter. The thrombus extraction catheter of this invention could be made for instance in sizes from 3F – 8F and in lengths of 80-175cm.

In reference to the Figures, FIG. 1 shows a perspective view of a catheter. The catheter can include a luer adapter 8. In an embodiment, the luer adapter 8 can be coupled or attached to the proximal end of the catheter. The luer adapter 8 can be configured to couple or attach a suction device to the catheter. The outer diameter of the catheter, such as the outer diameter of the main tubular shaft can be 0.039-0.105 inches.

FIG. 2 shows a cross-section of the catheter. The catheter can include a first main lumen 1, a second lumen 4, a distal tip structure 5, and a proximal portion 3. The second lumen 4 can be configured for a guidewire to pass through the lumen. The distal tip structure 5 can be coupled to the distal portion of the first main lumen, such as with metal fusion. The distal tip structure 5 can be angled at its distal end, such as from 30-60 degrees from the central axis of the lumen.

FIG. 3 shows a perspective view of a catheter with an alternative embodiment of the distal tip potion 7. The distal tip portion 7 can include metal, such as being constructed primarily of metal. The distal tip portion 7 can include a strut attached to the outside wall of the first main lumen and extending distally and attached at a second point to the second lumen at a point distal to the termination of the first lumen, such as to provide a guard inhibiting suction of the artery or vein wall against the first lumen opening. In an embodiment, the 0.5-2.0mm of the distal tip can be coated with gold.

FIG. 4 shows a cross-section of a portion of the wall of the first lumen. The first lumen can include a polymeric layer 6. The first lumen can include a multi-filar coil structure 2. The internal surface of the first lumen can be coated with a silicone friction reducing polymer.

It should be noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to a composition containing "a compound" includes a mixture of two or more compounds. It should also be noted that the term “or” is generally employed in its sense including “and/or” unless the content clearly dictates otherwise.

It should also be noted that, as used in this specification and the appended claims, the phrase “configured” describes a system, apparatus, or other structure that is constructed or configured to perform a particular task or adopt a particular configuration to. The phrase "configured" can be used interchangeably with other similar phrases such as arranged and configured, constructed and arranged, constructed, manufactured and arranged, and the like.

All publications and patent applications in this specification are indicative of the level of ordinary skill in the art to which this invention pertains. All publications and patent applications are herein incorporated by reference to the same extent as if each individual publication or patent application was specifically and individually indicated by reference.

The invention has been described with reference to various specific and preferred embodiments and techniques. However, it should be understood that many variations and modifications may be made while remaining within the spirit and scope of the invention.

The Claims Are:

1. A two lumen catheter for use in arterial or veinous interventional procedures for extracting thrombus or clot comprising:

a first main lumen (1) configured for sucking or aspirating a blood clot, the first main lumen extending from the distal tip to the proximal end, the first lumen comprising metal with a metal internal surface where the distal portion is constructed from a swaged, multi-filar coil structure (2), such that the individual coil wire cross-sections are substantially rectangular in shape, a proximal portion (3) of the first lumen attached to the distal portion and being made of substantially metal tubing, the proximal portion of the first lumen being metallically fused to the distal portion, the proximal portion being terminated at its proximal end with a luer adapter (8);

a second lumen (4), configured to a guidwire to pass through, extending from the distal tip and exiting or terminating at a point proximal of the distal tip at a distance of 1-50cm, the second lumen being attached adjacent to an outside wall of the first main lumen; and

a distal tip structure (5) attached to the distal portion of the first main lumen that is substantially constructed of metal and angled at its distal end in an amount of 30-60 degrees from the central axis of the lumen, the distal tip being attached by metal fusion to the distal coil portion, the distal tip being externally coated with a gold plating for enhanced radiopacity.

2. The two lumen catheter of any of claims 1 and 3-31, wherein the distal tip portion (7) is made substantially of metal and has a strut attached to the outside wall of the first main lumen and extending distally and attached at a second point to the second lumen at a point distal to the termination of the first lumen so as to provide a guard inhibiting suction of the artery or vein wall against the first lumen opening.

3. The two lumen catheter of any of claims 1-2 and 4-31, wherein entire external and internal surfaces of the device are jacketed or coated with a thin polymeric layer (6).

4. The two lumen catheter of any of claims 1-3 and 5-31, wherein the external surface of the distal portion of the device is coated with hydrophilic polymer.

5. The two lumen catheter of any of claims 1-4 and 6-31, wherein the internal surface of the first lumen is coated with a silicone friction reducing polymer.

6. The two lumen catheter of any of claims 1-5 and 7-31, wherein the distal portion of the main lumen has individual coil wire cross-sections that are elliptical in shape.

7. The two lumen catheter of any of claims 1-6 and 8-31, wherein the metal helically wound multi-filar layer is made of stainless steel.

8. The two lumen catheter of any of claims 1-7 and 9-31, wherein the multi-filar structure is made using 6-20 filars.

9. The two lumen catheter of any of claims 1-8 and 10-31, wherein the multi-filar structure wire has been swaged so as to impart a rectangular cross-section and intimate fitting contact between adjacent wires.

10. The two lumen catheter of any of claims 1-9 and 11-31, wherein the outer diameter of the main tubular shaft is between .039 – 0.105".

11. The two lumen catheter of any of claims 1-10 and 12-31, wherein the outer polymer jacket is made of PTFE.

12. The two lumen catheter of any of claims 1-11 and 13-31, wherein the outer polymer jacket is made of nylon.

13. The two lumen catheter of any of claims 1-12 and 14-31, wherein the outer polymer jacket is coated with a hydrophilic polymer.

14. The two lumen catheter of any of claims 1-13 and 15-31, wherein the inner polymer jacket is made of PTFE.

15. The two lumen catheter of any of claims 1-14 and 16-31, wherein the inner polymer jacket is made of a PTFE/Pebax composite layer.

16. The two lumen catheter of any of claims 1-15 and 17-31, wherein the inner polymer jacket is made of nylon.

17. The two lumen catheter of any of claims 1-16 and 18-31, wherein the inner polymer jacket is coated with a hydrophilic polymer.

18. The two lumen catheter of any of claims 1-17 and 19-31, wherein the distal portion is made of a PTFE inner layer and Pebax outer layer.

19. The two lumen catheter of any of claims 1-18 and 20-31, wherein the helical multi-filar inner layer has welded terminations.

20. The two lumen catheter of any of claims 1-19 and 21-31, where the helical multi-filar inner layer has a distal tip that has been coated with gold for 0.5-2 mm.

21. The two lumen catheter of any of claims 1-20 and 22-31, wherein the outer jacket is made of Pebax.

22. The two lumen catheter of any of claims 1-21 and 23-31, wherein the outer jacket is made of two layers of Pebax.

23. The two lumen catheter of any of claims 1-22 and 24-31, wherein the outer jacket layer is heat shrinkable to allow it to be formed tightly onto the helical multi-filar structure.

24. The two lumen catheter of any of claims 1-23 and 25-31, wherein the multi-filar structure wire has a rectangular cross-section.

25. The two lumen catheter of any of claims 1-24 and 26-31, wherein the multi-filar structure wire has a circular cross-section.

26. The two lumen catheter of any of claims 1-25 and 27-31, wherein the multi-filar structure wire has a oval or elliptical cross-section.

27. The two lumen catheter of any of claims 1-26 and 28-31, wherein the multi-filar structure wires have been coated with PTFE coating prior to forming into the multi-filar configuration.

28. The two lumen catheter of any of claims 1-27 and 29-31, wherein the first lumen comprises at least 35% metal.

29. The two lumen catheter of any of claims 1-28 and 30-31, wherein the first lumen comprises 35%-65% metal.

30. The two lumen catheter of any of claims 1-29 and 31, wherein the distal portion is 10-50cm in length.

31. The two lumen catheter of any of claims 1-30, wherein the proximal portion is 50-100cm in length.

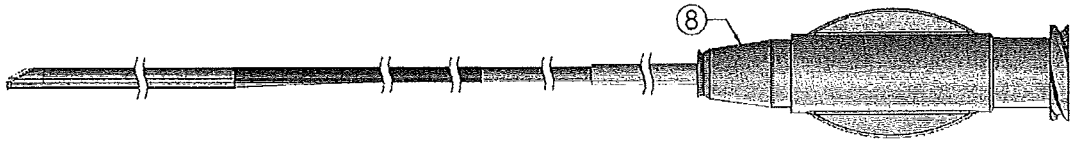

FIG. 1

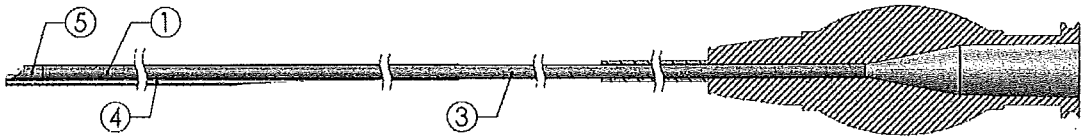

FIG. 2

FIG. 3

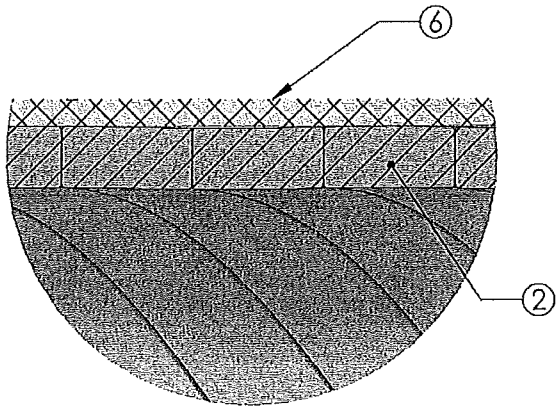

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/035142

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/22(2006.01)i, A61M 25/01(2006.01)i, A61L 29/04(2006.01)i, A61L 29/02(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)
A61B 17/22; A61M 25/09; A61M 25/092; A61M 25/00; A61M 1/00; A61M 25/01; A61L 29/04; A61L 29/02

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) & Keywords:two lumen catheter, thrombus, clot, extract, first main lumen, second lumen, guidewire, multi-filar coil, distal tip structure, metal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012-0016344 A1 (KUSAKABE, SUSUMU) 19 January 2012 See paragraphs [0026]-[0035]; and figures 1-2B.	1
A	US 2006-0276774 A1 (MORI, SATORU) 7 December 2006 See paragraphs [0021], [0022], [0026], [0027], [0030], [0031]; and figures 1-6.	1
A	US 6152909 A (BAGAOISAN et al.) 28 November 2000 See column 8, line 47-column 9, line 24; column 10, line 60-column 11, line 65; and figures 5-7B, 13, 14.	1
A	US 2009-0270800 A1 (SPURCHISE et al.) 29 October 2009 See paragraphs [0030]-[0038]; and figures 1A-1C.	1
A	US 7608063 B2 (LE et al.) 27 October 2009 See column 3, line 37-column 5, line 53; and figures 1-9.	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	Date of mailing of the international search report
08 October 2014 (08.10.2014)	**10 October 2014 (10.10.2014)**

Name and mailing address of the ISA/KR
International Application Division
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
CHANG, Bong Ho
Telephone No. +82-42-481-3353

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/035142

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.: 2-31
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 addtional 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 any 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.:

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/US2014/035142

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012-0016344 A1	19/01/2012	CN 102335023 A	01/02/2012
		EP 2407200 A1	18/01/2012
		EP 2407200 B1	19/06/2013
		JP 2012-035059 A	23/02/2012
US 2006-0276774 A1	07/12/2006	AT 451136 T	15/12/2009
		DE 602006010937 D1	21/01/2010
		EP 1728531 A1	06/12/2006
		EP 1728531 B1	09/12/2009
		ES 2335522 T3	29/03/2010
		JP 04518044 B2	04/08/2010
		JP 2007-007388 A	18/01/2007
US 6152909 A	28/11/2000	AU 1999-15335 A1	15/06/1999
		AU 1999-15335 B2	03/05/2001
		AU 1999-28696 A1	06/09/1999
		AU 1999-28697 A1	06/09/1999
		AU 1999-33014 A1	06/09/1999
		AU 2000-37512 A1	04/10/2000
		CA 2164983 A1	08/12/1994
		CA 2286998 A1	11/09/1998
		CA 2287072 A1	11/09/1998
		CA 2310640 A1	03/06/1999
		CA 2322876 A1	11/09/1998
		CN 1225027 A0	04/08/1999
		EP 0702600 A1	27/03/1996
		EP 0702600 B1	19/11/1997
		EP 0901392 A2	01/10/2003
		EP 0901392 B1	31/03/2004
		EP 0904125 A2	31/07/2002
		EP 0906135 A2	26/02/2003
		EP 0906135 B1	29/12/2004
		EP 0969895 A1	12/01/2000
		EP 0996480 A2	03/05/2000
		EP 1011775 A1	28/06/2000
		EP 1011775 B1	17/05/2006
		EP 1023100 A2	02/08/2000
		EP 1023100 B1	09/05/2012
		EP 1032452 A1	06/09/2000
		EP 1056502 A2	06/12/2000
		EP 1164944 A1	02/01/2002
		EP 1164944 B1	23/07/2008
		JP 03202749 B2	27/08/2001
		JP 03690815 B2	31/08/2005
		JP 08-510684 A	12/11/1996
		JP 2000-511082 A	29/08/2000
		JP 2001-248765 A	14/09/2001
		JP 2001-508670 A	03/07/2001
		JP 2001-514544 A	11/09/2001

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/035142

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		JP 2001-517970 A	09/10/2001
		JP 2001-523535 A	27/11/2001
		JP 2001-526559 A	18/12/2001
		JP 2002-503529 A	05/02/2002
		US 2001-0049517 A1	06/12/2001
		US 2002-0010420 A1	24/01/2002
		US 2002-0016565 A1	07/02/2002
		US 2002-0026145 A1	28/02/2002
		US 2002-0029031 A1	07/03/2002
		US 2002-0035347 A1	21/03/2002
		US 2002-0052638 A1	02/05/2002
		US 2002-0062092 A1	23/05/2002
		US 2002-0062119 A1	23/05/2002
		US 2002-0065507 A1	30/05/2002
		US 2002-0091407 A1	11/07/2002
		US 2002-0095137 A1	18/07/2002
		US 2002-0133117 A1	19/09/2002
		US 2002-0174944 A1	28/11/2002
		US 2003-0009146 A1	09/01/2003
		US 2003-0023227 A1	30/01/2003
		US 2003-0055398 A1	20/03/2003
		US 2003-0208222 A1	06/11/2003
		US 2004-0015150 A1	22/01/2004
		US 2004-0054347 A1	18/03/2004
		US 2005-0245866 A1	03/11/2005
		US 2005-0245894 A1	03/11/2005
		US 2006-0200074 A1	07/09/2006
		US 2006-0200075 A1	07/09/2006
		US 2006-0200191 A1	07/09/2006
		US 2006-0265000 A1	23/11/2006
		US 2007-0060942 A2	15/03/2007
		US 5522551 A	04/06/1996
		US 5634595 A	03/06/1997
		US 5833644 A	10/11/1998
		US 5833650 A	10/11/1998
		US 5865377 A	02/02/1999
		US 5868705 A	09/02/1999
		US 6022336 A	08/02/2000
		US 6050972 A	18/04/2000
		US 6068623 A	30/05/2000
		US 6135991 A	24/10/2000
		US 6190332 B1	20/02/2001
		US 6217567 B1	17/04/2001
		US 6270477 B1	07/08/2001
		US 6312407 B1	06/11/2001
		US 6319229 B1	20/11/2001
		US 6325777 B1	04/12/2001
		US 6325778 B1	04/12/2001
		US 6355014 B1	12/03/2002
		US 6355016 B1	12/03/2002

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/035142

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 6375628 B1	23/04/2002
		US 6375629 B1	23/04/2002
		US 6398773 B1	04/06/2002
		US 6454741 B1	24/09/2002
		US 6464816 B1	15/10/2002
		US 6468230 B2	22/10/2002
		US 6500166 B1	31/12/2002
		US 6544276 B1	08/04/2003
		US 6554795 B2	29/04/2003
		US 6569148 B2	27/05/2003
		US 6605074 B2	12/08/2003
		US 6652480 B1	25/11/2003
		US 6669670 B1	30/12/2003
		US 6786888 B1	07/09/2004
		US 6790204 B2	14/09/2004
		US 6805692 B2	19/10/2004
		US 6849068 B1	01/02/2005
		US 6936126 B2	30/08/2005
		US 6958059 B2	25/10/2005
		US 6986778 B2	17/01/2006
		US 6994689 B1	07/02/2006
		US 7033344 B2	25/04/2006
		US 7169126 B2	30/01/2007
		US 7316661 B2	08/01/2008
		WO 00-54673 A1	21/09/2000
		WO 94-27728 A1	08/12/1994
		WO 97-44082 A2	27/11/1997
		WO 97-44084 A2	27/11/1997
		WO 97-44085 A2	27/11/1997
		WO 98-38929 A1	11/09/1998
		WO 98-38930 A1	11/09/1998
		WO 98-39044 A2	11/09/1998
		WO 98-39044 A3	30/03/2000
		WO 98-39046 A1	11/09/1998
		WO 98-39047 A1	11/09/1998
		WO 98-39048 A2	11/09/1998
		WO 99-26692 A1	03/06/1999
		WO 99-42059 A2	26/08/1999
		WO 99-42157 A2	26/08/1999
		WO 99-42158 A2	26/08/1999
US 2009-0270800 A1	29/10/2009	US 7947012 B2	24/05/2011
US 7608063 B2	27/10/2009	AT 552877 T	15/04/2012
		CN 101389371 A	18/03/2009
		CN 101389371 B	29/02/2012
		EP 1986728 A2	05/11/2008
		EP 1986728 A4	05/01/2011
		EP 1986728 B1	11/04/2012
		JP 03-156227 U	02/12/2009

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/035142

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2007-0197956 A1	23/08/2007
		WO 2007-100585 A2	07/09/2007
		WO 2007-100585 A3	02/05/2008