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(71) Applicant (for all designated States except US): **GAM-BRO LUNDIA AB** [SE/SE]; P.O. Box 10101, S-220 10 Lund (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **JANSSON, Olof** [SE/SE]; Näktergalsgatan 33, S-235 38 Vellinge (SE).
OLDE, Bo [SE/SE]; Läsavägen 20, S-224 67 Lund (SE).

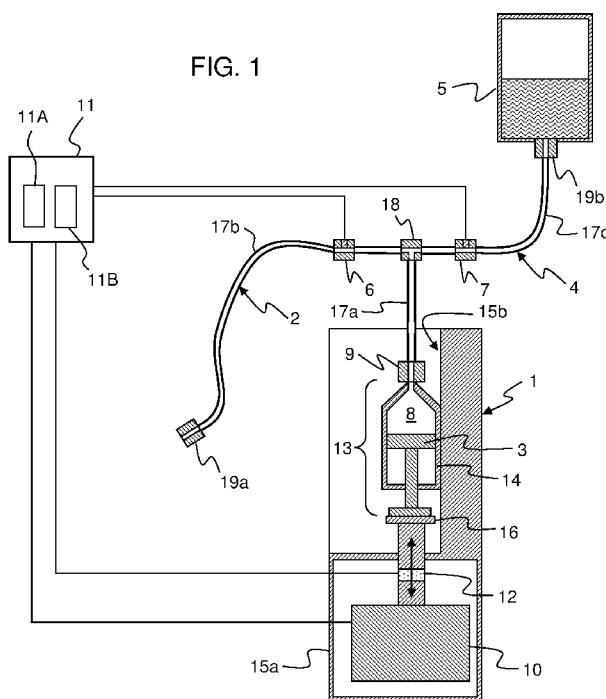
(74) Agents: **BORNEGÅRD, Annette** et al.; P.O. Box 10101, S-220 10 Lund (SE).

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[Continued on next page]

(54) Title: INFUSION SYSTEM AND METHOD OF DETECTING AND ELIMINATING AIR



(57) Abstract: An infusion system defines a fill path (4) for an infusion liquid from a source (5) to a displacement volume in a fluid chamber (8) of an infusion pump (1), and an infusion path (2) from the displacement volume to a connector (19a). The infusion pump (1) is operated to repeatedly draw infusion liquid from the source (5) into the displacement volume via the fill path (4) and push infusion liquid from the displacement volume through the connector (19a) via the infusion path (2). A controller (11) selectively effects a priming operation, by operating the infusion pump (1) to generate a priming fill stroke, in which a priming volume of the infusion liquid is drawn from the source (5) to the displacement volume, and a priming pump stroke, in which at least part of the priming volume is pushed from the displacement volume back to the source (5). The infusion system is thereby operable to be primed automatically, and proper priming may be verified by evaluating a measurement signal representative of fluid pressure in the displacement volume during either of the priming fill stroke and the priming pump stroke.



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))
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- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- of inventorship (Rule 4.17(iv))

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28 February 2013

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2012/054074

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.: 1-10, 33
because they relate to subject matter not required to be searched by this Authority, namely:
see FURTHER INFORMATION sheet PCT/ISA/210
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.:

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

International application No
PCT/EP2012/054074

A. CLASSIFICATION OF SUBJECT MATTER INV. A61M5/142 A61M5/168 A61M5/36 A61M1/36 ADD. A61M5/14														
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 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 <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>WO 2009/044221 A1 (GAMBRO LUNDIA AB [SE]; CALEFFI LUCA [IT]; SAKOTA RANKO [IT]; FRANZONI) 9 April 2009 (2009-04-09) the whole document -----</td> <td>11-32, 34-37</td> </tr> <tr> <td>X</td> <td>US 6 416 293 B1 (BOUCHARD CLEMENT D [US] ET AL) 9 July 2002 (2002-07-09) abstract; figures 1-9 column 3, lines 8-20 column 13, lines 21-67 column 19, line 14 - column 21, line 18 -----</td> <td>11-13</td> </tr> <tr> <td>X</td> <td>WO 93/12825 A1 (ABBOTT LAB [US]) 8 July 1993 (1993-07-08) the whole document ----- -/-</td> <td>11-13</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	WO 2009/044221 A1 (GAMBRO LUNDIA AB [SE]; CALEFFI LUCA [IT]; SAKOTA RANKO [IT]; FRANZONI) 9 April 2009 (2009-04-09) the whole document -----	11-32, 34-37	X	US 6 416 293 B1 (BOUCHARD CLEMENT D [US] ET AL) 9 July 2002 (2002-07-09) abstract; figures 1-9 column 3, lines 8-20 column 13, lines 21-67 column 19, line 14 - column 21, line 18 -----	11-13	X	WO 93/12825 A1 (ABBOTT LAB [US]) 8 July 1993 (1993-07-08) the whole document ----- -/-	11-13
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X	WO 2009/044221 A1 (GAMBRO LUNDIA AB [SE]; CALEFFI LUCA [IT]; SAKOTA RANKO [IT]; FRANZONI) 9 April 2009 (2009-04-09) the whole document -----	11-32, 34-37												
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X	WO 93/12825 A1 (ABBOTT LAB [US]) 8 July 1993 (1993-07-08) the whole document ----- -/-	11-13												
☒ 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												
14 December 2012		04/01/2013												
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Petersch, Bernhard												

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/054074

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 5 935 105 A (MANNING ROBERT [US] ET AL) 10 August 1999 (1999-08-10) the whole document -----	11-14, 20-32, 34-37
X	WO 02/13890 A1 (ABBOTT LAB [US]) 21 February 2002 (2002-02-21) the whole document -----	11-13
X	EP 1 319 417 A1 (BRAUN MEDIZINTECHNOLOGIE GMBH [DE]) 18 June 2003 (2003-06-18) abstract; figure 1 paragraphs [0012], [0023], [0030], [0033], [0036], [0046] -----	11-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/054074

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EP 1319417	A1	18-06-2003	NONE

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 11-13

claims 11-13 essentially defines a computer program for operating an infusion system and a particular form of infusion pump and control device therefore

2. claims: 14-32, 34-37

claims 14-32 and 34-37 essentially define an infusion system having a fluid recirculation path and control device therefore and a tubing and connector kit

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 1-10, 33

Claims 1-10 as well as 33 refer to methods "of operating an infusion system" and hence methods treatment of the human/animal body by surgery and therapy practised on the human/animal body in the sense of Rule 39.1(iv) and Rule 67.1(iv) PCT, in particular in the light of the description description page 9, lines 19-29, and since claim 1 explicitly includes the step of "operating the infusion pump (1) to [...] push infusion liquid [...] via the infusion path (2)" (which leads to a patient, see page 9), which is why these claims have not been searched (Rule 39.1 PCT). In addition, no examination according to article 33(1) PCT is carried out for these claims (Rule 67.1 PCT).