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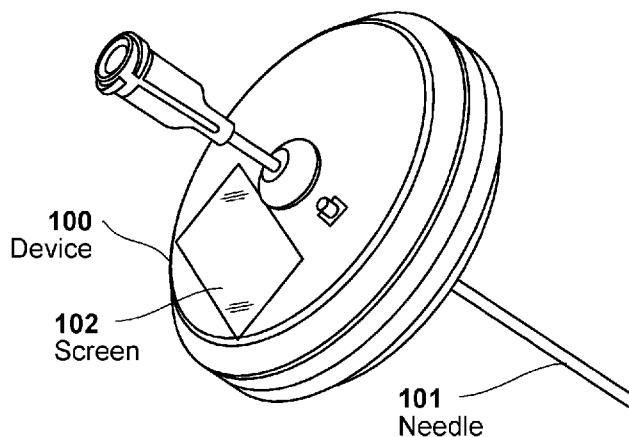
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(54) Title: GUIDING THE INSERTION OF A SURGICAL NEEDLE WITH INERTIAL MEASUREMENTS

FIG. 1A



(57) Abstract: Provided are surgical devices for guiding the insertion of a needle along a desired three-dimensional trajectory from a surgical entry site to a surgical destination site. The device includes an element for securely attaching a needle to the housing of the device. The orientation of the device can be calibrated relative to the patient, and an inertial measurement unit (IMU) within the device allows the current orientation to be continuously monitored after calibration. The current orientation is compared to the desired orientation, and this relationship is transmitted to a display for viewing by the surgeon. As such, the surgeon is aware of whether the device and needle are oriented along the desired trajectory, thereby helping the surgeon to adjust the orientation and be confident the desired orientation is achieved. Methods of using such devices to perform the guided insertion of the needle are also described.



DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE,
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2024/033669

A. CLASSIFICATION OF SUBJECT MATTER
 IPC - INV. A61B 34/20; A61B 34/00 (2024.01)
 ADD. A61B 34/30; A61B 34/32 (2024.01)
 CPC - INV. A61B 34/20; A61B 34/00
 ADD. A61B 34/30; A61B 34/32
 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)
 See Search History document
 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 See Search History document
 Electronic database consulted during the international search (name of database and, where practicable, search terms used)
 See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---	US 2020/0197099 A1 (XU, S. et al.) 25 June 2020; Entire Document	1, 7 ---
A		2-6, 8-9, 57, 59-61
A	US 2012/0245598 A1 (BROWN, S. et al.) 27 September 2012; Entire Document	1-9, 57, 59-61
A	US 2022/0331012 A1 (NORTHGATE TECHNOLOGIES INC.) 20 October 2022; Entire Document	1-9, 57, 59-61
A	US 2017/0311978 A1 (CHIENG, Y.) 02 November 2017; Entire Document	1-9, 57, 59-61

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"D" document cited by the applicant in the international application	"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
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"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	

Date of the actual completion of the international search 11 November 2024 (11.11.2024)	Date of mailing of the international search report DEC 02 2024
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Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2024/033669

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.: 10-56, 58, 62-76, 80-86
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:

Group I: Claims 1-9, 57, 59-61

Group II: Claims 77-79, 87

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 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.:
1-9, 57, 59-61

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.