



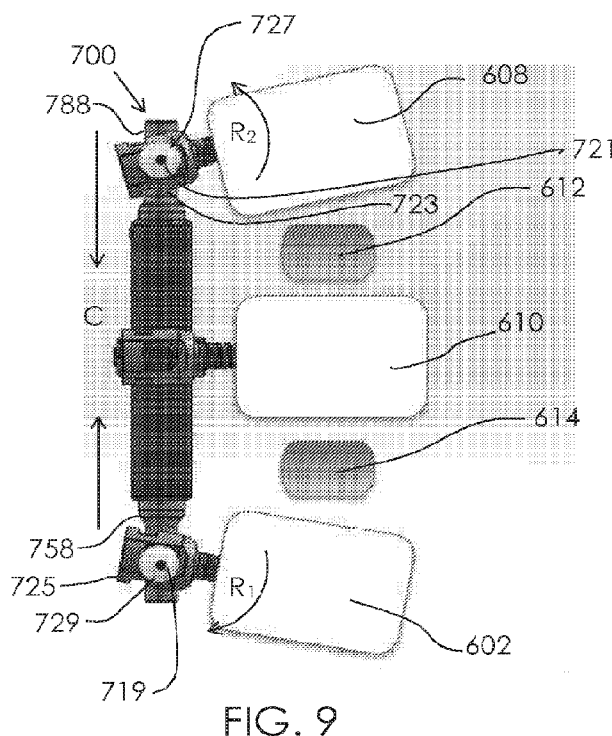
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[Continued on next page]

(54) Title: SYSTEMS AND METHODS FOR VERTEBRAL ADJUSTMENT



(57) Abstract: A system for non-invasively adjusting the curvature of a spine includes a housing having a first end and a second end, a first rod having a first end telescopically disposed within a cavity of the housing along a first longitudinal axis at the first end of the housing and having a first threaded portion extending thereon, and a second end configured to be coupled to a first portion of a spinal system of a subject, a second rod having a first end telescopically disposed within the cavity along a second longitudinal axis at the second end of the housing and having a second threaded portion extending thereon, and a second end configured to be coupled to a second portion of the spinal system of the subject, a driving member rotatably disposed within the cavity and configured to be activated from a location external to the body of the subject.



(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, 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.

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Published:

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/18797

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61B 17/70, A61B 17/64 (2016.01)

CPC - A61B 17/7016, A61B 17/7014, A61B 17/70, A61B 17/7002, A61B 17/702

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)
CPC - A61B 17/7016; USPC - 606/260Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A61B 17/7014, A61B 17/70, A61B 17/7002, A61B 17/702, A61B 17/7064, A61B 17/7067, A61B 17/7077; IPC(8) - A61B 17/64 (2016.01); USPC - 606/258, 606/259, 606/264, 606/57, 606/63, 606/60, 606/105, 623/23.45 (keyword limited; terms below)Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase; Google (Web, Patents, Scholar) Search Terms Used: spinal distraction curvature adjust alter fix housing structure frame cavity opening hole channel aperture rod pole bar shaft telescoping threaded tapping rotating driving member magnetic motor (see Search Strategy for complete list)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/0283781 A1 (Arnin), 08 November 2012 (08.11.2012), entire document, especially Fig. 2 and 4; para [0001], [0004], [0026-[0028] and [0035]	1-33, 37-120, and 124-154 and 156-174
A	US 6,849,076 B2 (Blunn et al.), 01 February 2005 (01.02.2005), entire document, especially Fig. 5; col 4, ln 65 to col 5, ln 33	1-33, 37-120, and 124-154 and 156-174
A	US 8,828,058 B2 (Elsebaie et al.), 09 September 2014 (09.09.2014), entire document	1-33, 37-120, and 124-154 and 156-174
A	US 2014/0031870 A1 (Chang et al.), 30 January 2014 (30.01.2014), entire document	1-33, 37-120, and 124-154 and 156-174
A	US 2014/0250674 A1 (Pool et al.), 11 September 2014 (11.09.2014), entire document	1-33, 37-120, and 124-154 and 156-174

☐ Further documents are listed in the continuation of Box C.

* 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

07 July 2016

Date of mailing of the international search report

05 AUG 2016

Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/18797

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.: 34-36 and 121-123
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:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-33, 37-120, and 124-174, directed to a system for non-invasively adjusting the curvature of a spine wherein rotation of the driving member in a first direction causes the second threaded driver to move the first end of the second rod into the cavity of the housing.

Group II: Claims 175-191 directed to a system for adjusting the curvature of a spine wherein the first rod and second rod are parallel.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

-*-Continued in Supplemental Box-*-

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.: 1-33, 37-120, 124-154 and 156-174

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.

-*- Box III - Observations where Unity of Invention is Lacking -*-

SPECIAL TECHNICAL FEATURES

The invention of Group I includes the special technical features of a first interface rotationally coupling a first threaded driver to the driving member, the first threaded driver threadingly engaging the first threaded portion of the first rod; a second interface rotationally coupling a second threaded driver to the driving member, the second threaded driver threadingly engaging the second threaded portion of the second rod; and wherein rotation of the driving member in a first direction causes the first threaded driver to move the first end of the first rod into the cavity of the housing along the first longitudinal axis, not required by the claims of Group II.

The invention of Group II includes the special technical features of the second ends of the first and second rods being coupled to a first and second vertebra of the spinal system, the second vertebra immediately adjacent the first vertebra; and wherein the direction from the first end to the second end of the first rod is generally parallel to the direction from the first end to the second end of the second rod, not required by the claims of Group I.

COMMON TECHNICAL FEATURES

Groups I-II share the common technical features of a housing having a first end and a second end and a cavity between the first end and the second end; a first rod having a first end telescopically disposed within the cavity of the housing along a first longitudinal axis at the first end of the housing and having a first threaded portion extending thereon, and a second end configured to be coupled to a first portion of a spinal system of a subject; a second rod having a first end telescopically disposed within the cavity of the housing along a second longitudinal axis at the second end of the housing and having a second threaded portion extending thereon, and a second end configured to be coupled to a second portion of the spinal system of the subject; and a driving member rotatably disposed within the cavity of the housing and configured to be activated from a location external to the body of the subject. However, these shared technical features do not represent a contribution over prior art as being anticipated by US 2012/0283781 A1 to Armin et al. (hereinafter 'Armin'), which discloses a housing (housing 209, Fig. 2) having a first end (upper end of housing 209, Fig. 2) and a second end (lower end of housing 209, Fig. 2) and a cavity between the first end and the second end (inner space of housing 209 in which sleeve 203, rods 201/202, motor 206 and other components are contained, Fig. 2); a first rod (rod 201, Fig. 2) having a first end telescopically disposed within the cavity of the housing along a first longitudinal axis at the first end of the housing (lower end of rod 201 is disposed within the upper end of housing 209 along an axis formed by rod 201, Fig. 2; rods are telescopically disposed because they can be moved in and out of the housing 209 by rotation of sleeve 203, para [0026]) and having a first threaded portion extending thereon (rod 201 is threadingly received by sleeve 203 at the first end, para [0026], and thus has threads; Fig. 2), and a second end configured to be coupled to a first portion of a spinal system of a subject (upper end of rod 201 has mounting structure 215 for attachment to spinal structure, para [0027]; Fig. 2); a second rod (rod 202, Fig. 2) having a first end telescopically disposed within the cavity of the housing along a second longitudinal axis at the second end of the housing (upper end of rod 202 is disposed within the lower end of housing 209 along an axis formed by rod 202, Fig. 2; rods are telescopically disposed because they can be moved in and out of the housing 209 by rotation of sleeve 203, para [0026]) and having a second threaded portion extending thereon (rod 202 is threadingly received by sleeve 203 at the first end, para [0026], and thus has threads; Fig. 2), and a second end configured to be coupled to a second portion of the spinal system of the subject (lower end of rod 202 has mounting structure 215 for attachment to spinal structure, para [0027]; Fig. 2); and a driving member rotatably disposed within the cavity of the housing (actuating motor 206 and gear 204 are disposed within the cavity of housing 209, Fig. 2; gear 204 rotates to rotate the sleeve 203, para [0028]) and configured to be activated from a location external to the body of the subject (motor 206 and gear 204 can be controlled by external unit via remote control, para [0028]).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical feature that would otherwise unify the groups.

Therefore, Groups I-II lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

NOTE: Claims 34-36 and 121-123 are unsearchable because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a). Accordingly, they are not included with any invention.

NOTE: Claims 176 to 191 appear to contain typographical errors as to their dependency. It is evident from the claims that they are intended to be dependents from independent claim 175 in some fashion. Accordingly, they are included in groups above as such.

Claim 154 in its entirety recites "The system of claim 153 further comprising:". However, this recitation is not a complete sentence and fails to further limit the invention in any manner. Claim 155 then recites in its entirety, "an external remote controller configured to produce a rotating magnetic field capable of rotating the radially-poled permanent magnet." This appears to be a typographical error - the recitations of claims 154-155 are intended to be the substance of a single claim, rather than split amongst two separate claims. Accordingly, for the purposes of this search report and written opinion, claims 154-155 are re-written as reciting "154. The system of claim 153 further comprising: an external remote controller configured to produce a rotating magnetic field capable of rotating the radially-poled permanent magnet." As a result, while claim 155 is included in Group I, it does not exist in the application as construed.