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(71) Applicant: **LIFE SPINE, INC.** [US/US]; 13951 South Quality Drive, 13951 South Quality Drive, Huntley, IL 60142 (US).

(72) Inventor: **MEHL, David, T.**; 3210 Banford Circle, 3210 Banford Circle, Lake In The Hills, IL 60156 (US).

(74) Agent: **ANDERSON, Scott D.** et al.; Foley & Lardner LLP, 3000 K Street, Suite 1600, Washington, DC 20007-5109 (US).

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Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- 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))
- of inventorship (Rule 4.17(iv))

(54) Title: VERTEBRAL DISC AUGER

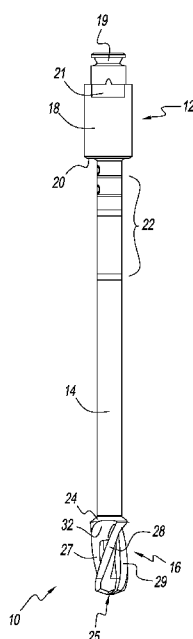


Fig. 1

(57) Abstract: A medical instrument (10) for shaving, collecting, and removing vertebral disc material from a vertebral disc space of a spine, has a shaft (14) defining a proximal shaft end and a distal shaft end, and an auger (16) at the distal shaft end. The auger has a plurality of helical cutting flutes (27, 28, 29) configured to shave and collect vertebral disc material from the vertebral disc through rotation of the auger. Each helical cutting flute (27, 28, 29) has a cutting apex (38, 39, 30) that together define a cutting tip (25), and a radially inward helical slot (42, 43, 44) that collectively define an internal cavity (36) for collection of cut vertebral disc material. The plurality of cutting apexes converge at the cutting tip (25), defining a point. The medical instrument (10) includes a connector (19) to allow attachment of a handle. A notch (21) in the proximal shaft end that receives a flange of a handle to prevent rotation of the handle relative to the auger.

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VERTEBRAL DISC AUGER

FIELD OF THE INVENTION

The present invention relates to instruments for spine procedures and, more particularly, to instruments for removing vertebral disc material from a vertebral disc space of a spine.

BACKGROUND OF THE INVENTION

A large majority of people develop spine issues because of age, disease, trauma, acquired complication, and/or other reason. Some spine issues can be alleviated without surgery while other spine issues necessitate surgery. In some circumstances, it may be necessary to remove vertebral disc material from between adjacent vertebrae of the spine. Such a procedure is now routinely accomplished using minimally invasive surgery or micro invasive surgery (collectively, MIS). Both procedures reduce bodily trauma by utilizing surgical instruments that are introduced into the body via a small incision via a cannula and/or an endoscope (i.e. tube). The medical instrument is inserted into and through the tube and operated accordingly.

Various forms of medical instruments are known to provide vertebral disc material collection and/or removal. Many, however, are not suitable for use in MIS. One form of suitable MIS medical instrument for removing vertebral disc material from the vertebral disc space of adjacent vertebrae of the spine is an auger. A vertebral disc material auger for MIS has a head designed for insertion into and through a tube for harvesting vertebral disc tissue. Current MIS augers for harvesting vertebral disc material from a vertebral disc space between adjacent vertebrae of a spine however, are deficient in various respects.

It would therefore be advantageous to have an MIS medical instrument for harvesting vertebral disc material that overcomes the deficiencies of the prior art. It would therefore be further advantageous to have an MIS auger for harvesting vertebral disc material that reduces surgical complexity. It would furthermore be

advantageous to have an auger for an MIS spine procedure that provides efficient collecting and removing of vertebral disc material.

The present MIS medical instrument addresses the above and more.

SUMMARY OF THE INVENTION

A medical instrument for removing vertebral disc material particularly, but not necessarily, during an MIS spine procedure, has a proximal end configured as or for attachment to a handle, a shaft extending from the proximal end, and a head formed as an auger at a distal end of the shaft, the auger having a plurality of cutting flutes configured to shave and collect vertebral disc material from a vertebral disc in a vertebral disc space of a spine through rotation of the auger.

The cutting flutes spiral or twist along a longitudinal axis of the shaft. In one form, the auger has three spiral cutting flutes, each spiral cutting flute making a 120° rotation about the head along the longitudinal axis of the shaft from a tip. Other numbers of spiral cutting flutes as well as their amount of rotation about the head along the longitudinal axis of the shaft are contemplated and may be used. Each one of the plurality of spiral cutting flutes extends from an angled apex which together, form the tip at the distal end of the auger.

A cavity is formed in the auger with each one of the plurality of spiral cutting flutes having a radially inward slot in communication with the cavity. Each slot extends along the longitudinal axis of the respective spiral cutting flute. The internal cavity of the auger and the slots of the spiral cutting flutes together define an area for collection of cut vertebral disc material.

The proximal end may include a notch or other structure configured to receive a flange or other structure of a handle, or configured as a handle.

The auger may extend from a neck at the distal end of the shaft with each one of the plurality of spiral cutting flutes having a proximal end that extends from the neck, each one of the proximal ends of the spiral cutting flutes having a surface sloped radially inward from the neck.

Further aspects of the present invention will become apparent from consideration of the drawings and the following description of the invention. A person skilled in the art will realize that other forms of the invention are possible and that the details of the invention can be modified in a number of respects without departing

from the inventive concept. The following drawings and description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention and its features will be better understood by reference to the accompanying drawings, wherein:

Fig. 1 is a side view of a medical instrument for removing vertebral disc material from a vertebral disc space of a spine fashioned in accordance with the present principles;

Fig. 2 is an enlarged view of a distal end of the medical instrument of Fig. 1 particularly depicting a head thereof in the form of an auger;

Fig. 3 is an enlarged view of the auger of the medical instrument of Fig. 1;

Fig. 4 is another enlarged view of the auger of the medical instrument of Fig. 1 rotated 90° with respect to the view of Fig. 4; and

Fig. 5 is an enlarged view of a tip of the auger of the medical instrument of Fig. 1.

For the purposes of promoting an understanding of the principles of the invention reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Any alterations and further modifications in the described embodiment, and any further applications of the principles of the invention as described herein are contemplated as would normally occur to one skilled in the art to which the invention relates.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figures 1-5, there is shown a medical instrument, generally designated 10, for removing vertebral disc material (not shown), typically from within a disc space (not shown) between adjacent vertebrae (not shown) of a spine during a surgical spine procedure, particularly, but not necessarily, in minimally invasive or micro invasive surgery (MIS) via a cannula, endoscopic, tube, or the like, or a similar spine procedure. The present medical instrument 10 may be used in surgical procedures other than MIS procedures. The medical instrument 10 is fashioned from one or more surgical grade materials.

Fig. 1 depicts an overall view of the medical instrument 10, also termed a vertebral disc auger. The vertebral disc auger 10 has a proximal end 12 configured as to define a handle or handle receptor (collectively, handle 12), a shaft 14 connected to a distal end 20 of the handle 12, and a head 16 fashioned as an auger connected to a distal end of the shaft 14 through a neck 24. The handle 12 is characterized by a cylindrical body 18 sized to accommodate a hand (not shown) or a handle via a generally conical connector 19 at a proximal end of the cylindrical body 18, and to the distal end 20. The connector 19 is configured to allow connection to a handle (not seen). Alternately, a handle (not seen) may be attached to the connector 19 as a permanent part of the vertebral disc auger 10, or the configuration as shown can be the handle. The cylindrical body 18 is shown with a notch 21 that is configured to receive a handle. The cylindrical body 18 may have additional notches (not shown) or other configuration(s) that would be designed to receive a handle. The notch 21 (and any additional notches/configuration(s)) provide anti-rotation of a handle with respect to the cylindrical body 18 such that rotation of the handle will rotate the shaft 14 and auger 16. The distal end 20 of the cylindrical body 18 is generally planar and can serve as a stop against further insertion into an MIS tube, endoscope, cannula, or the like (not shown, and collectively "cannula") during use. Rotation of the cylindrical body 18 rotates the shaft 14 and thus the auger 16.

Figs. 2-4 depict various views of the auger 16. The auger 16 is configured to cut, shave, or otherwise remove vertebral discs/disc material (not shown) from a spine (not shown), collect the shaven vertebral disc material, and remove the collected vertebral disc material. Cutting and collecting the vertebral disc material is accomplished by rotation of the auger 16. Removal of the vertebral disc material is accomplished by removing the auger 16 from the vertebral disc space and from the cannula.

The auger 16 has a plurality of helical cutting flutes or blades for slicing into vertebral disc material. In the embodiment shown in the figures, the auger 16 has three (3) helical cutting flutes 27, 28, 29. Each helical cutting flute 27, 28, 29 extends from a respective sloped surface 32, 33, 34 at a distal end of the neck 24, winds or spirals around the auger 16, relative to a longitudinal axis of the shaft 14, and terminates in a cutting tip 25. Each flute spirals or twists 120° from its apex (sloped surfaces) along the longitudinal axis of the shaft 14. Other numbers of cutting flutes

may be provided as well as the amount of twist along the longitudinal axis of the shaft 14. Upon rotation of the auger 16, the helicity of the cutting flutes aid in advancing the auger into the disc material by creating a pathway. Each helical cutting flute 27, 28, 29 has a respective helical slot 42, 43, 44 that is situated radially inward of an outer diameter of the auger 16. The helical slots 42, 43, 44 form, or at least partially form, an internal central cavity 36 within the auger 16. The central cavity 36 collects cut/shaven disc material for removal. Removal is accomplished by extracting the auger 16 from the vertebral disc space and the body.

Fig. 5 depicts an enlarged view of the cutting tip 25 as viewed from the distal end of the auger 16. The helical cutting flute 27 terminates at its distal end in a cutting apex 38. The helical cutting flute 28 terminates at its distal end in a cutting apex 39. The helical cutting flute 29 terminates at its distal end in a cutting apex 40. The cutting apexes 38, 39, 40 converge to form the cutting tip 25.

In use, as the auger 16 advances forward into the disc material through rotation of the proximal end 12/shaft 14, the helical cutting flutes 27, 28, 29 collect disc material into the helical slots 42, 43, 44/central cavity 36 for the purpose of removing the disc material.

The shaft 14 is shown with depth markings 22 on its outside diameter for assisting with depth reference within a patient. Other types of depth markings/references may be used.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only a preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected. It should be understood that while the use of words such as preferable, preferably, preferred or more preferred utilized in the description above indicate that the feature so described may be more desirable, it nonetheless may not be necessary and embodiments lacking the same may be contemplated as within the scope of the invention.

CLAIMS

What is claimed is:

1. A medical instrument (10) for obtaining vertebral disc material from a vertebral disc in a vertebral disc space of a spine during a surgical spine procedure, the medical instrument comprising:

a shaft (14) having a proximal shaft end and a distal shaft end;

a handle portion (12) at the proximal shaft end; and

an auger (16) formed at the distal shaft end, the auger having a plurality of helical cutting flutes (27, 28, 29) configured to shave and collect vertebral disc material from a vertebral disc in a vertebral disc space of a spine through rotation of the shaft (14), each one of the plurality of helical cutting flutes having a cutting apex (38, 39, 40) that all together define a cutting tip (25), with each one of the plurality of helical cutting flutes (27, 28, 29) having a radially inward helical slot (42, 43, 44) that collectively define an internal cavity (36) in the auger for collection of cut vertebral disc material.

2. The medical instrument (10) of claim 1, wherein the plurality of cutting apexes (38, 39, 40) converge at the cutting tip (25) to define a point.

3. The medical instrument (10) of claim 2, wherein the plurality of helical cutting flutes (27, 28, 29) comprises three helical cutting flutes.

4. The medical instrument (10) of claim 1, wherein the handle portion (12) comprises a handle.

5. The medical instrument (10) of claim 1, wherein:

the handle portion (12) comprises a cylindrical body (18) defining a proximal cylindrical body end and a distal cylindrical body end (20) with the distal cylindrical body end connected to the distal shaft end; and

the proximal cylindrical body end has a connector (19) configured to allow attachment of a handle to the handle portion (12).

6. The medical instrument (10) of claim 5, wherein the proximal cylindrical body end has a notch (21) that receives a flange of the handle for preventing rotation of the handle relative to the cylindrical body.

7. The medical instrument (10) of claim 6, wherein the proximal cylindrical body end has depth markings (22).

8. The medical instrument (10) of claim 1, wherein the auger (16) extends from a neck (24) at the distal shaft end with each one of the plurality of helical cutting flutes (27, 28, 29) having a proximal end (32, 33, 34) that extends from the neck, each one of the proximal ends of the helical cutting flutes having a surface sloped radially inward from the neck.

9. A method of removing vertebral disc material from a vertebral disc in a vertebral disc space of a spine comprising:

providing an incision in a patient proximate a vertebral disc to be cut;

inserting a tube having a proximal tube end and a distal tube end into the incision such that the distal tube end is proximate to the vertebral disc to be cut;

providing a medical instrument (10) having a shaft (14) defining a proximal shaft end and a distal shaft end, a handle portion (12) at the proximal shaft end, and an auger (16) formed at the distal shaft end, the auger having a plurality of helical cutting flutes (27, 28, 29) configured to shave and collect vertebral disc material from a vertebral disc in a vertebral disc space of a spine through rotation of the shaft, each one of the plurality of helical cutting flutes having a cutting apex (38, 39, 40) that all together define a cutting tip (25), with each one of the plurality of helical cutting flutes having a radially inward helical slot (42, 43, 44) that collectively define an internal cavity (36) in the auger for collection of cut vertebral disc material; and

placing the medical instrument (10) into and through the tube such that the auger extends from the distal tube end and is adjacent the vertebral disc to be cut;

rotating the medical instrument (10) to rotate the auger (16) into the vertebral disc to cut vertebral disc material from the vertebral disc; and

removing the medical instrument (10) from the tube.

10. The method of claim 9, wherein the plurality of cutting apexes (38, 39, 40) converge at the cutting tip (25) to define a point.
11. The method of claim 10, wherein the plurality of helical cutting flutes (27, 28, 29) comprises three helical cutting flutes.
12. The method of claim 9, wherein the handle portion (12) comprises a handle.
13. The method of claim 9, wherein:
the handle portion (12) comprises a cylindrical body (18) defining a proximal cylindrical body end and a distal cylindrical body end (20) with the distal cylindrical body end connected to the distal shaft end; and
the proximal cylindrical body end has a connector (19) configured to allow attachment of a handle to the handle portion (12).
14. The method of claim 13, wherein the proximal cylindrical body end has a notch (21) that receives a flange of the handle for preventing rotation of the handle relative to the cylindrical body (18).
15. The method of claim 13, wherein the proximal cylindrical body end has depth markings (22).
16. The method of claim 9, wherein the auger (16) extends from a neck (24) at the distal shaft end with each one of the plurality of helical cutting flutes (27, 28, 29) having a proximal end (32, 33, 34) that extends from the neck, each one of the proximal ends of the helical cutting flutes having a surface sloped radially inward from the neck.

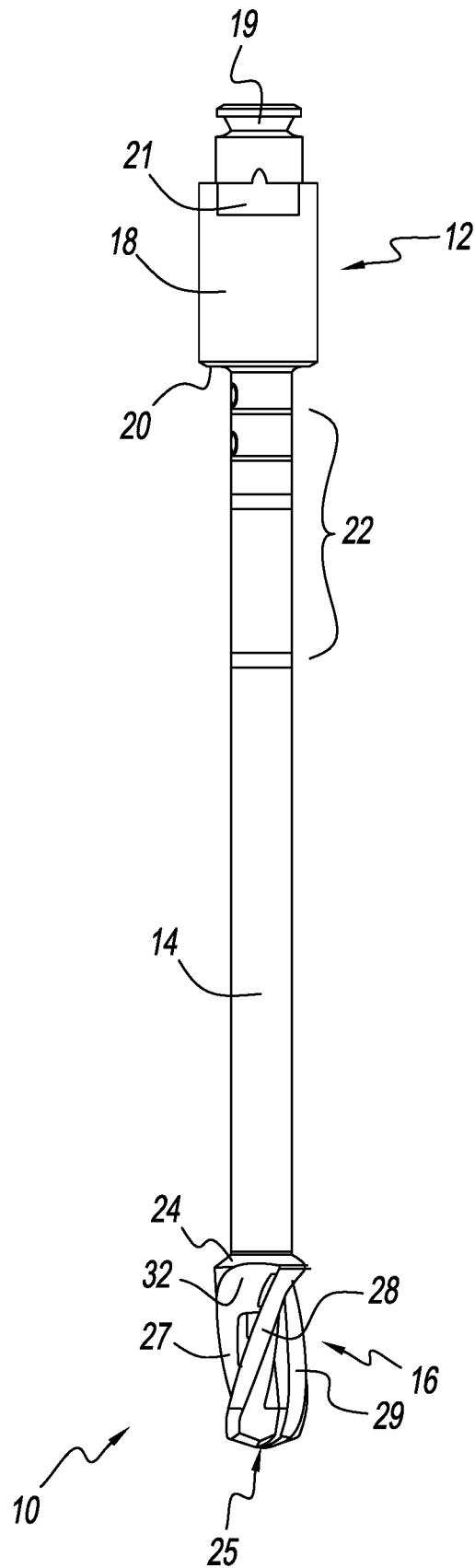


Fig. 1

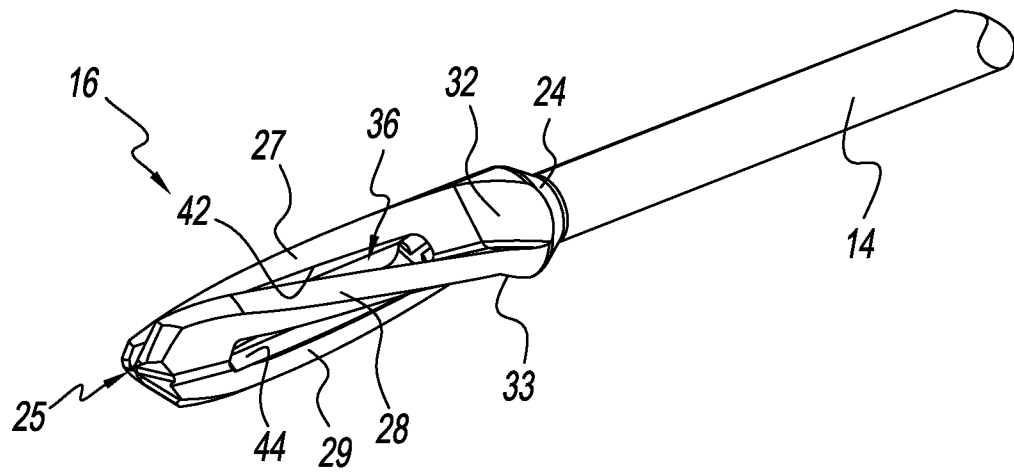


Fig. 2

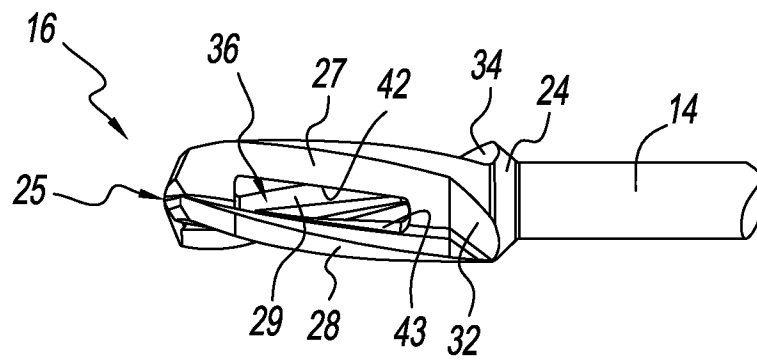


FIG. 3

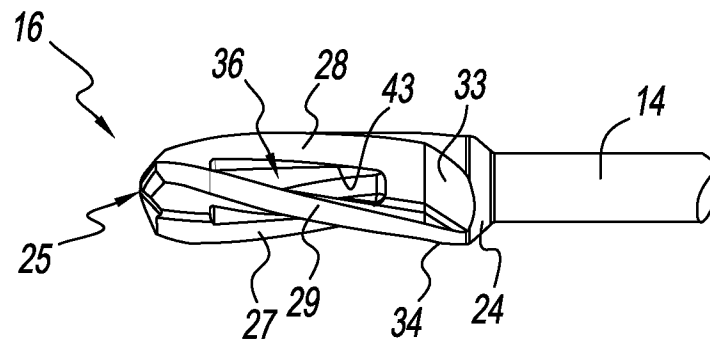


FIG. 4

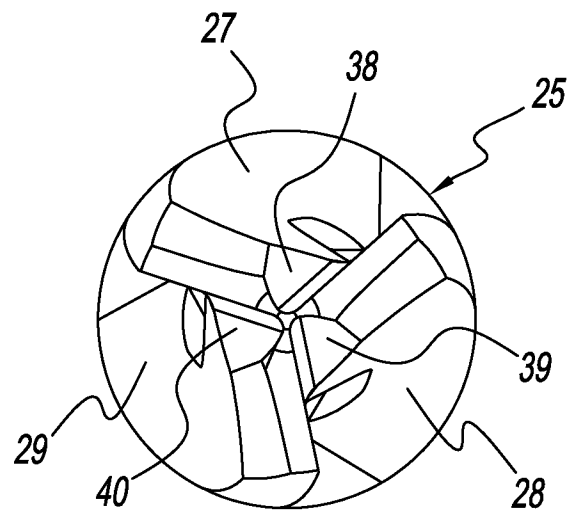


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2023/013769

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B17/32 A61B17/16
ADD.

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

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 759 185 A (GRINBERG ALEXANDER [US]) 2 June 1998 (1998-06-02) column 3, line 61 - column 4, line 22; figures 3-4 -----	1-8
A	US 2020/352579 A1 (DAVIS DARREN L [US] ET AL) 12 November 2020 (2020-11-12) paragraph [0066]; figures 6-8 -----	1
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☒ 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

24 April 2023

Date of mailing of the international search report

04/05/2023

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

Moers, Roelof

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2023/013769

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 20 2011 002653 U1 (BIOMED EST [LI]) 26 May 2011 (2011-05-26) paragraph [0026]; figures 2, 3 -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2023/013769

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.: **9-16**
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT – Method for treatment of the human or animal body by surgery
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 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

Information on patent family members

International application No

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