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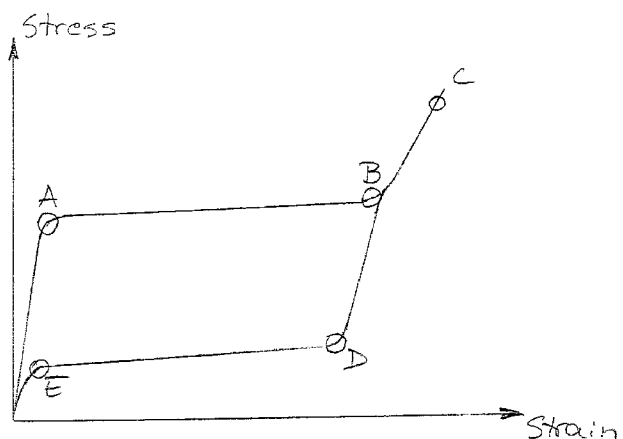
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DAMPING APPARATUS, USE OF A SHAPE MEMORY ALLOY AND METHOD FOR CHANGING DAMPING CHARACTERISTICS



(57) Abstract: A damping and shock absorbing method and apparatus for permanent or non-permanent use in the human body consists out of a shape memory alloy material which is cycled through the stress-strain hysteresis to dissipate energy for an effective damping. A sufficiently high pre-stress is applied to the damping element(s) to ensure that the damping working range is within the superelastic cycle. The damping apparatus can be designed to work in tension or compression or - by combination of compression and tension elements - both in tension and compression. Moreover, damping elements from a shape memory alloy can be designed to work also in flexion and extension as well in rotation. The damping apparatus can be designed to have a stroke and force suitable for use in the human body by the design, the structure and the chemical composition of the shape memory alloy and their pre-set properties, such as plateau stresses of the superelastic cycle depend on the ambient temperature, the force of damping elements can also be changed in-situ by changing the temperature of the damping elements. The damping elements out of a shape memory alloy can be combined with elastic elements out of other materials to achieve stress- strain behaviour more suitable for use in the individual human body.



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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2006/009552

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B17/70 F16F3/02 F16F15/02

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)

F16F

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 practical, 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	EP 1 016 765 A2 (FIP IND [IT]) 5 July 2000 (2000-07-05) the whole document	1-5,8-11
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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 document 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

10 January 2007

Date of mailing of the International search report

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2006/009552

G(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	GIL F J ET AL: "SHAPE MEMORY ALLOYS FOR MEDICAL APPLICATIONS" PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS. JOURNAL OF ENGINEERING IN MEDICINE. PART H, MECHANICAL ENGINEERING PUBLICATIONS LTD, LONDON, GB, vol. 212, no. H06, 1998, pages 473-488, XP000823783 ISSN: 0954-4119 the whole document	1
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A	TAUTZENBERGER P: "DAMPFUNGSVERMOGEN VON FORMGEDACHTNIS-LEGIERUNGEN" ZEITSCHRIFT FUER WIRTSCHAFTLICHEN FERTIGUNG, MUENCHEN, DE, vol. 84, no. 4, January 1989 (1989-01), pages 215-217, XP000350651 ISSN: 0044-3743 the whole document	1
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP 2006/009552

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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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2006/009552

Box 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.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box 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 fee, this Authority did not invite payment of any additional fee.
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.:

see annex

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-11

A damping apparatus, comprising at least one damping element made of a shape memory alloy and exhibiting superelastic stress-strain behavior over a predetermined range of temperatures, and biasing means for applying a non-zero biasing force to said damping element.

2. claims: 11-12

Use of a shape memory alloy damping device as an intervertebral implant.

3. claims: 14-16

A method for changing the damping characteristics of a shape memory alloy damping device, comprising the step of heating or cooling said shape memory alloy damping device in situ.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2006/009552

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