

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
13 December 2001 (13.12.2001)

PCT

(10) International Publication Number
WO 01/93786 A3

(51) International Patent Classification⁷: **A61F 2/44**,
B29C 67/00, B22F 3/105

(21) International Application Number: PCT/US01/40848

(22) International Filing Date: 5 June 2001 (05.06.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/588,167 5 June 2000 (05.06.2000) US
60/291,183 15 May 2001 (15.05.2001) US

(71) Applicant (for all designated States except US):
TENSEGRA, INC. [US/US]; 110 Kerry Place, Nor-
wood, MA 02062 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MANASAS, Mark**
[US/US]; 25 Trimount Street, Dedham, MA 02026
(US). **OSLAKOVIC, Keith, E.** [US/US]; 114 Walden
Street, Cambridge, MA 02140 (US). **SULTAN, Cornel**
[US/US]; Apartment 4, 17 Webster Street, Everett, MA
02149 (US). **HAMILTON, John, V.** [US/US]; 31 Hill
Street, Foxboro, MA 02035 (US). **INGBER, Donald,**

E. [US/US]; 71 Montgomery Street, Boston, MA 02116
(US). **SAMMARCO, Carmine** [US/US]; 12 Orchard
Street, Medfield, MA 02052 (US). **KUMMAILIL, John**
[IN/US]; 45 Auburn Street, #3, Framingham, MA 01701
(US). **SKINNER, David, J.** [GB/US]; 22 Claire Avenue,
Mansfield, MA 02048 (US).

(74) Agent: **ANASTASI, John, N.**; Wolf, Greenfield & Sacks,
P.C., 600 Atlantic Avenue, Boston, MA 02210 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,
SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA,
ZW.

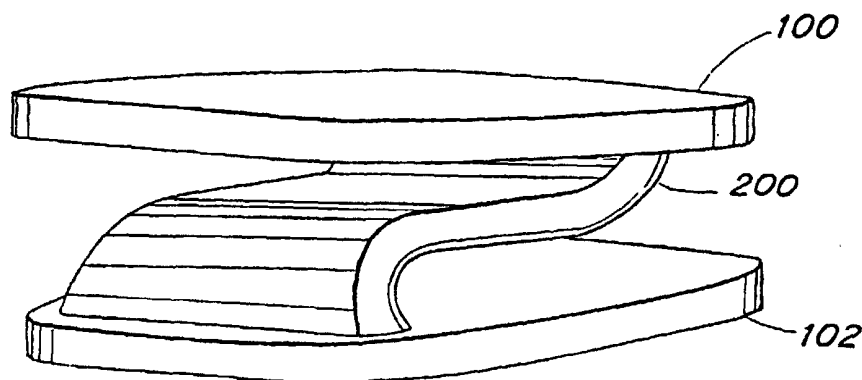
(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,
CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

[Continued on next page]

(54) Title: ORTHOPEDIC IMPLANT AND METHOD OF MAKING METAL ARTICLES



(57) Abstract: The present application is directed to an orthopedic implant. More specifically, the orthopedic implant is suitable for arthroplasty procedures where optimized multifunctional behavior of the implant is desired. In some embodiments the implant is suitable for the replacement of a spinal disc. In one embodiment, the present application is directed to an orthopedic implant including a first plate a second plate and a flexible support. The flexible support may have a single connection to the first plate and a single connection to the second plate and may vary in cross section. The first plate, the second plate and the flexible support may be unitarily formed. This application is also directed to methods of producing metal articles having microstructure for improved mechanical properties. Such methods may be suitable for the production of medical devices. In one embodiment, the method includes directing a stream including a particulate material in a pattern corresponding to at least a portion of a structure of an orthopedic implant and fusing at least a portion of the particulate material with a laser.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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(88) Date of publication of the international search report:

18 April 2002

INTERNATIONAL SEARCH REPORT

In **ational Application No**

PCT/US 01/40848

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61F2/44 B29C67/00 B22F3/105

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)

IPC 7 A61F B29C B22F

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 320 644 A (BAUMGARTNER WALTER) 14 June 1994 (1994-06-14) claims 1,8,10; figures 1-9 column 2, line 67 -column 3, line 16	1-7,9, 11-15,19
A	---	10
X	DE 43 15 757 C (PLUS ENDOPROTHETIK AG) 10 November 1994 (1994-11-10) claim 1; figures 1-4,8	1-4,6,7, 13
A	---	5
X	US 6 019 793 A (PERREN STEPHAN M ET AL) 1 February 2000 (2000-02-01) claims 5,6,8,9; figures	1-7, 9-11,19
Y	---	8
A	---	15,16
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

5 February 2002

Date of mailing of the international search report

20. 02. 2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Stach, R

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/40848

3.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 676 702 A (RATRON YVES-ALAIN) 14 October 1997 (1997-10-14) claims 1,2,6,7; figures	15,19
A	---	1-3,5-7, 9-14
Y	US 5 458 642 A (BEER JACQUELINE M ET AL) 17 October 1995 (1995-10-17) claims 1,3; figures	8
A	---	1,3-6,8
X	WO 96 40002 A (MASSACHUSETTS INST TECHNOLOGY ;CHILDRENS MEDICAL CENTER (US)) 19 December 1996 (1996-12-19) claims 19,20,28 page 10, line 8 - line 18	17
A	---	18
X	WO 96 05038 A (UNIV TEXAS) 22 February 1996 (1996-02-22) column 4, line 34 - line 64 column 5, line 65 -column 8, line 30	17
X	US 5 155 324 A (BEAMAN JOSEPH J ET AL) 13 October 1992 (1992-10-13) claim 1 column 1, line 16 - line 42 column 12, line 10 - line 30	18
A	---	17
A	US 5 354 414 A (FEYGIN MICHAEL) 11 October 1994 (1994-10-11) claim 5 column 6, line 59 -column 7, line 41 column 22, line 36 - line 60	17
A	---	18
A	DE 195 33 960 A (FRAUNHOFER GES FORSCHUNG) 20 March 1997 (1997-03-20) claims 1,5; figures 16,17	18
A	---	17
P,X	US 6 046 426 A (JEANTETTE FRANCISCO P ET AL) 4 April 2000 (2000-04-04) cited in the application claim 1	17

	US 6 144 008 A (RABINOVICH JOSHUA E) 7 November 2000 (2000-11-07) the whole document	17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/40848

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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.:

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: 1-16, 19

An orthopedic implant comprising a first plate, a second plate and a flexible support connecting the first and second plate.

(Problem: Giving the implant a flexibility that is close to that of the replaced natural structure, e.g. a spinal disc)

2. Claim : 17

An orthopedic implant produced by a method comprising directing a stream including particulate material in a pattern and fusing at least a portion of the particulate material with a laser.

(Problem: Producing an implant out of a particulated material)

3. Claim : 18

An article comprising a metallic component comprising layers including grains of precipitated phase wherein a majority of the grains in each layer are oriented in two substantially opposed directions.

(Problem: Improving the mechanical properties of an article by producing a layered material with a well defined microstructure)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/40848

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5320644	A	14-06-1994	AT 133555 T	15-02-1996
			DE 59205228 D1	14-03-1996
			EP 0538183 A1	21-04-1993
			ES 2082430 T3	16-03-1996
DE 4315757	C	10-11-1994	DE 4315757 C1	10-11-1994
			WO 9426213 A1	24-11-1994
			EP 0697843 A1	28-02-1996
			JP 8509645 T	15-10-1996
US 6019793	A	01-02-2000	WO 9817207 A1	30-04-1998
US 5676702	A	14-10-1997	FR 2728159 A1	21-06-1996
			DE 69515435 D1	13-04-2000
			DE 69515435 T2	03-08-2000
			EP 0716841 A1	19-06-1996
US 5458642	A	17-10-1995	WO 9519153 A1	20-07-1995
WO 9640002	A	19-12-1996	US 6176874 B1	23-01-2001
			CA 2222323 A1	19-12-1996
			EP 0836453 A1	22-04-1998
			JP 11507256 T	29-06-1999
			WO 9640002 A1	19-12-1996
WO 9605038	A	22-02-1996	US 5639402 A	17-06-1997
			AU 702229 B2	18-02-1999
			AU 3361495 A	07-03-1996
			EP 0775046 A1	28-05-1997
			JP 10508324 T	18-08-1998
			WO 9605038 A1	22-02-1996
			US 2001005797 A1	28-06-2001
			US 6183515 B1	06-02-2001
US 5155324	A	13-10-1992	US 4937420 A	26-06-1990
			US 5017753 A	21-05-1991
			US 4863538 A	05-09-1989
			AU 9016791 A	11-06-1992
			WO 9208567 A1	29-05-1992
			AT 116179 T	15-01-1995
			AT 138294 T	15-06-1996
			AT 138293 T	15-06-1996
			AU 603412 B2	15-11-1990
			AU 1046688 A	06-05-1988
			AU 659289 B2	11-05-1995
			AU 3524193 A	13-05-1993
			AU 632195 B2	17-12-1992
			AU 6834690 A	14-03-1991
			BG 47343 A3	15-06-1990
			BR 8707510 A	21-02-1989
			DE 3750931 D1	09-02-1995
			DE 3750931 T2	11-05-1995
			DE 3751818 D1	27-06-1996
			DE 3751818 T2	26-09-1996
			DE 3751819 D1	27-06-1996
			DE 3751819 T2	26-09-1996
			DE 8718128 U1	01-02-1996
			DE 287657 T1	18-08-1994

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/40848

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5155324	A		DK 329888 A	15-08-1988
			EP 0287657 A1	26-10-1988
			EP 0542729 A2	19-05-1993
			EP 0538244 A2	21-04-1993
			FI 882881 A ,B,	16-06-1988
			HK 194796 A	01-11-1996
			HK 205796 A	22-11-1996
			HK 205896 A	22-11-1996
			HU 56018 A2	29-07-1991
			HU 209081 B	28-03-1994
			JP 2542783 B2	09-10-1996
			JP 6192702 A	12-07-1994
			JP 2800937 B2	21-09-1998
			JP 8260163 A	08-10-1996
			JP 1502890 T	05-10-1989
			JP 2620353 B2	11-06-1997
			KR 9608015 B1	19-06-1996
			KR 9613714 B1	10-10-1996
			MC 1931 A	19-05-1989
			NO 175244 B	13-06-1994
			NO 920877 A	16-08-1988
			RU 2021881 C1	30-10-1994
			WO 8802677 A2	21-04-1988
			US 5597589 A	28-01-1997
			US 5616294 A	01-04-1997
			US 5639070 A	17-06-1997
US 5354414	A	11-10-1994	US 5637175 A	10-06-1997
			US 5876550 A	02-03-1999
			AU 4504089 A	01-05-1990
			WO 9003893 A1	19-04-1990
DE 19533960	A	20-03-1997	DE 19533960 A1	20-03-1997
			AT 197259 T	15-11-2000
			DE 59606092 D1	07-12-2000
			WO 9710067 A1	20-03-1997
			EP 0790875 A1	27-08-1997
US 6046426	A	04-04-2000	US 2001008230 A1	19-07-2001
US 6144008	A	07-11-2000	NONE	