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- (74) Agents: **VICCARO, Patrick J.** et al.; 1000 Six PPG Place, Pittsburgh, Pennsylvania 15222 (US).

- (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, 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, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: THERMO-MECHANICAL PROCESSING OF NICKEL-BASE ALLOYS

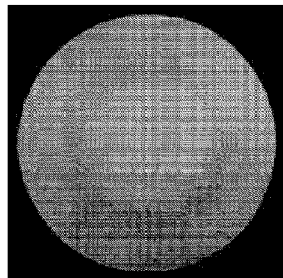


FIG. 3A

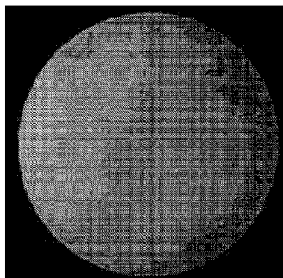


FIG. 3C

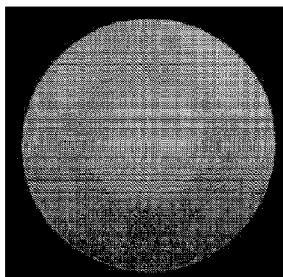


FIG. 3B

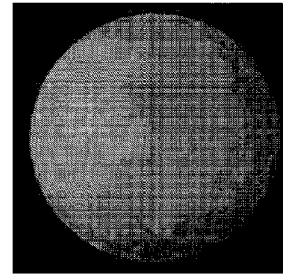


FIG. 3D

(57) Abstract: A thermo-mechanical treatment process is disclosed. A nickel-base alloy workpiece is heated in a first heating step to a temperature greater than the M23C6 carbide solvus temperature of the nickel-base alloy. The nickel-base alloy workpiece is worked in a first working step to a reduction in area of 20% to 70%. The nickel-base alloy workpiece is at a temperature greater than the M23C6 carbide solvus temperature when the first working step begins. The nickel-base alloy workpiece is heated in a second working step to a temperature greater than 1700 F (926 C) and less than the M23C6 carbide solvus temperature of the nickel-base alloy. The nickel-base alloy workpiece is not permitted to cool to ambient temperature between completion of the first working step and the beginning of the second heating step. The nickel-base alloy workpiece is worked to a second reduction in area of 20% to 70%. The nickel-base alloy workpiece is at a temperature greater than 1700 F (926 C) and less than the M23C6 carbide solvus temperature of the nickel-base alloy when the second working step begins.





— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))* — *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
24 January 2013

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/036707

A. CLASSIFICATION OF SUBJECT MATTER
 INV. C22C19/05 C22F1/10
 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)
 C22F C22C

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	EP 0 109 350 A2 (MITSUBISHI HEAVY IND LTD [JP]; SUMITOMO METAL IND [JP]) 23 May 1984 (1984-05-23) page 5, line 6	9,10
X	EP 0 066 361 A2 (HUNTINGTON ALLOYS [US]) 8 December 1982 (1982-12-08) pages 3,5	11,14, 16,20, 22-24
X	JP 60 100655 A (MITSUBISHI METAL CORP) 4 June 1985 (1985-06-04) abstract	11,16, 17,23
A	EP 2 281 908 A1 (SUMITOMO METAL IND [JP]) 9 February 2011 (2011-02-09) the whole document	1-10
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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

21 November 2012

Date of mailing of the international search report

29/11/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Brown, Andrew

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/036707

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.:
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:

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 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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-10

A process and Product

2. claims: 11-25

A process and a product

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/036707

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009 299120 A (DAIDO STEEL CO LTD) 24 December 2009 (2009-12-24) abstract -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/036707

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0109350	A2	23-05-1984	DE 3382433 D1 21-11-1991
			DE 3382737 D1 10-03-1994
			DE 3382737 T2 19-05-1994
			EP 0109350 A2 23-05-1984

EP 0066361	A2	08-12-1982	CA 1194346 A1 01-10-1985
			DE 3269304 D1 03-04-1986
			EP 0066361 A2 08-12-1982
			ES 8306801 A1 16-09-1983
			JP 1369994 C 25-03-1987
			JP 57203741 A 14-12-1982
			JP 61034498 B 08-08-1986

JP 60100655	A	04-06-1985	JP 1427358 C 25-02-1988
			JP 60100655 A 04-06-1985
			JP 61057390 B 06-12-1986

EP 2281908	A1	09-02-2011	CA 2723526 A1 26-11-2009
			CN 102016090 A 13-04-2011
			EP 2281908 A1 09-02-2011
			JP 4433230 B2 17-03-2010
			KR 20100135304 A 24-12-2010
			US 2011183151 A1 28-07-2011
			WO 2009142228 A1 26-11-2009

JP 2009299120	A	24-12-2009	NONE
