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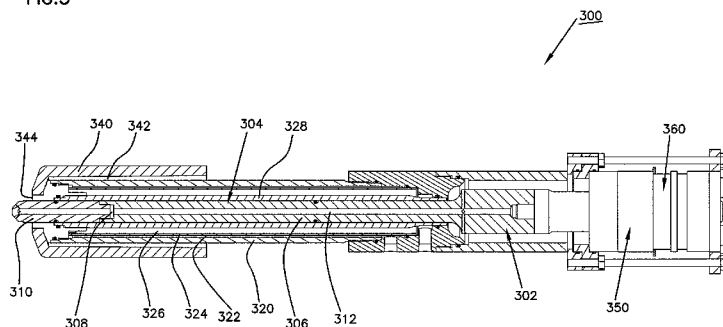
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(54) Title: NIOBIUM AS A PROTECTIVE BARRIER IN MOLTEN METALS

FIG.3



(57) Abstract: Devices may be in contact with molten metals such as copper, for example. The devices may include, but are not limited to, a die used for producing articles made from the molten metal, a sensor for determining an amount of a dissolved gas in the molten metal, or an ultrasonic device for reducing gas content (e.g., hydrogen) in the molten metal. Niobium may be used as a protective barrier for the devices when they are exposed to the molten metals.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/035983

A. CLASSIFICATION OF SUBJECT MATTER
INV. B06B3/00

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)
B06B

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	US 2006/024490 A1 (WERNER PAUL S [US] ET AL) 2 February 2006 (2006-02-02) paragraphs [0065], [0069], [0120]; figure 1	1-8
X	WO 2005/052207 A (TOUCHSTONE RES LAB LTD [US]; GORDON BRIAN L [US]; WOLFE GREGG W [US]) 9 June 2005 (2005-06-09) paragraphs [0029], [0056]; figure 1	1-8
X	US 2004/190733 A1 (NAYAR SATINDER K [US] ET AL) 30 September 2004 (2004-09-30) paragraphs [0017] - [0019], [0022]; figure 1	1-8
A	US 2006/127577 A1 (MIRANDA LUIZ ROBERTO M [BR] ET AL) 15 June 2006 (2006-06-15) paragraphs [0003], [0019]; claim 1	1

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
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- *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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/035983

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 allsearchable 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.:

see annex

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: 1-8

Ultrasonic device with tip comprising niobium

2. claims: 9-16

Die with an oxygen barrier

3. claims: 17-20

Gas sensor with eletrolyte tube

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/035983

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006024490 A1	02-02-2006	WO 2006023080 A1	02-03-2006
WO 2005052207 A	09-06-2005	EP 1697554 A2	06-09-2006
		JP 2007518876 T	12-07-2007
		KR 20060125817 A	06-12-2006
US 2004190733 A1	30-09-2004	CA 2520912 A1	04-11-2004
		CN 1802874 A	12-07-2006
		EP 1609334 A1	28-12-2005
		JP 2006522562 T	28-09-2006
		KR 20050119668 A	21-12-2005
		US 2008090023 A1	17-04-2008
		US 2008090024 A1	17-04-2008
		US 2007290575 A1	20-12-2007
		WO 2004095883 A1	04-11-2004
US 2006127577 A1	15-06-2006	AU 2002339277 A1	29-03-2004
		WO 2004022806 A1	18-03-2004
		BR 0203534 A	10-08-2004
		DK 1546424 T3	30-03-2009
		EP 1546424 A1	29-06-2005
		ES 2321073 T3	02-06-2009