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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

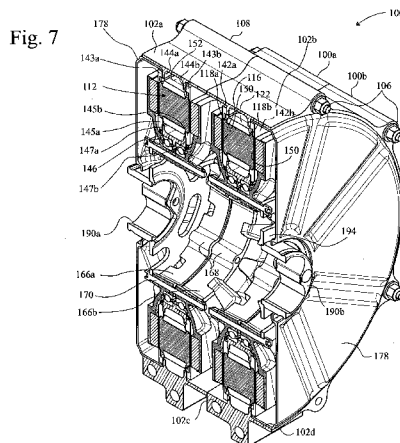
Published:

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

— 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))

(88) Date of publication of the international search report:
23 June 2011

(54) Title: ELECTRIC MACHINE - COOLING



(57) Abstract: An electric machine (10;100) comprises a rotor (14a, b) having permanent magnets (24a,b) and a stator (12) having coils (22) wound on stator bars (16) for interaction with the magnets across an air gap (26a, b) defined between them. The bars and coils are enclosed by a stator housing (42a,b; 102, 142a, b,146) that extends between the air gap and defines a chamber (52;152) incorporating cooling medium to cool the coils.



INTERNATIONAL SEARCH REPORT

International application No PCT/GB2010/050234

A. CLASSIFICATION OF SUBJECT MATTER INV. H02K9/197 H02K21/24 ADD. H02K15/12				
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) H02K				
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.		
Y	WO 00/48294 A1 (SCHILLER HELMUT [DE]) 17 August 2000 (2000-08-17) the whole document -----	1-5, 15		
Y	WO 2008/032430 A1 (NTN TOYO BEARING CO LTD [JP]; OZAKI TAKAYOSHI [JP]; YAMADA HIROYUKI [J]) 20 March 2008 (2008-03-20) abstract; figures 1,2,9,10,11 -----	1-5, 15		
X	JP 2005 261083 A (NISSAN MOTOR) 22 September 2005 (2005-09-22) abstract; figure 3 -----	1, 16-18, 21		
A	WO 98/07227 A1 (TURBO GENSET COMPANY LTD [GB]; PULLEN KEITH ROBERT [GB]; FENNOCCCHI ARN) 19 February 1998 (1998-02-19) figure 9a -----	19, 20		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> </tr> </table>			"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
"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	Date of mailing of the international search report			
20 April 2011	06/05/2011			
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 Türk, Severin			

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2010/050234

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.:

1-5, 15-21
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 PCT/GB2010/050234

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0048294	A1	17-08-2000	AT 239315 T 15-05-2003 CN 1343386 A 03-04-2002 EP 1153469 A1 14-11-2001 ES 2199138 T3 16-02-2004 JP 4468589 B2 26-05-2010 JP 2002537749 T 05-11-2002 US 6720688 B1 13-04-2004
WO 2008032430	A1	20-03-2008	NONE
JP 2005261083	A	22-09-2005	JP 4082359 B2 30-04-2008
WO 9807227	A1	19-02-1998	AT 279807 T 15-10-2004 AU 3780297 A 06-03-1998 DE 69731209 D1 18-11-2004 EP 0917757 A1 26-05-1999 ID 17826 A 29-01-1998 JP 2001500353 T 09-01-2001 US 6304011 B1 16-10-2001

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-5, 15

This invention is directed to an electric machine being an axial-flux machine also specifying details of the material of the stator housing.

2. claims: 1, 6-14

This invention relates to an electric machine with details of the shape of the stator housing.

3. claims: 1, 16-21

This invention is about an electric machine giving details of the supply / drainage of cooling medium.

4. claims: 1, 22-25

This invention concerns an electric machine where details of the electric insulation of the stator active parts are given, and a corresponding manufacturing method.
