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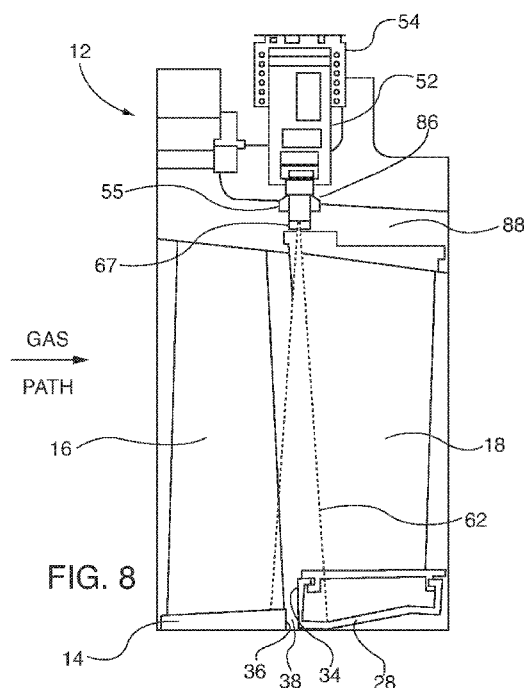
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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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(54) Title: SYSTEM AND METHOD FOR MONITORING HOOK WEAR IN A GAS TURBINE ENGINE



(57) Abstract: A system and method (90) for monitoring a gap size of a gap (38) between a seal holder (28) and an adjacent disk (14) in a compressor section (10) of a gas turbine. An imaging device (50) is used to generate at least one image of the gap, wherein a calibration image of the gap is generated when the gas turbine is in a cold state to provide a calibration gap size. An operational image of the gap is also generated when the gas turbine is in operation to provide an operational gap size. In addition, an enclosure (54) that houses the imaging device is attached to an access port (86) formed in the compressor section to provide a view of the gap for the imaging device. Wear is detected in a hook section (26) of the compressor section when the operational gap size is less than the calibration gap size.

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:

28 March 2019 (28.03.2019)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/012448

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.: 15-20
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:
see FURTHER INFORMATION sheet PCT/ISA/210
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:

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.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2018/012448

A. CLASSIFICATION OF SUBJECT MATTER
 INV. F01D21/04 F01D11/00
 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)
 F01D

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.
Y	US 2006/159547 A1 (GORDON THOMAS J [US] ET AL) 20 July 2006 (2006-07-20) abstract paragraph [0032] - paragraph [0034] figures	1-14
Y	US 2011/069165 A1 (ZOMBO PAUL J [US] ET AL) 24 March 2011 (2011-03-24) abstract paragraph [0003] paragraph [0041] - paragraph [0043] paragraph [0049] - paragraph [0052] figure 1	1-14
A	US 2013/235391 A1 (BALEINE ERWAN [US] ET AL) 12 September 2013 (2013-09-12) abstract paragraph [0026] - paragraph [0036] figures	1-14



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

31 January 2019

Date of mailing of the international search report

26/02/2019

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/012448

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006159547	A1	20-07-2006	NONE
US 2011069165	A1	24-03-2011	CA 2774479 A1 24-03-2011 CN 102576148 A 11-07-2012 EP 2478403 A1 25-07-2012 JP 5693584 B2 01-04-2015 JP 2013505477 A 14-02-2013 KR 20120064113 A 18-06-2012 US 2011069165 A1 24-03-2011 WO 2011034661 A1 24-03-2011
US 2013235391	A1	12-09-2013	NONE

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 15-20

In reply to the invitation to file a statement indicating the subject-matter to be searched, the applicant indicated the independent device claim 1, the independent method claim 7 and the dependent claims 2-6 and 8-14 as the basis for the search. Thus, pursuant to PCT Guidelines 9.34 and 9.35, the search report has been drawn up on the basis of these claims. The applicant's attention is drawn to the fact that the application will be further prosecuted on the basis of subject-matter for which a search has been carried out and that the claims should be limited to that subject-matter.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.