

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 16-1444-WO	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2017/064074	International filing date (<i>day/month/year</i>) 30 November 2017 (30.11.2017)	(Earliest) Priority Date (<i>day/month/year</i>) 28 December 2016 (28.12.2016)
Applicant X DEVELOPMENT LLC		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

the international application in the language in which it was filed

a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. **Certain claims were found unsearchable** (See Box No. II)

3. **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the **drawings** to be published with the abstract is Figure No. 34

as suggested by the applicant.

as selected by this Authority, because the applicant failed to suggest a figure.

as selected by this Authority, because this figure better characterizes the invention.

b. none of the figures is to be published with the abstract.

A. CLASSIFICATION OF SUBJECT MATTER**F02G 1/043(2006.01)i, F02G 1/055(2006.01)i, F01K 27/02(2006.01)i**

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)

F02G 1/043; F24J 2/34; F04D 27/02; F28D 20/00; F01K 25/10; H02K 7/18; F01K 7/38; F04D 29/58; F02G 5/02; F17C 9/02; F02C 1/04; F02G 1/055; F01K 27/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: heat engine, turbine, compressor, recuperator, heat exchanger, storage, tank, path, Brayton

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015-0260463 A1 (GIGAWATT DAY STORAGE SYSTEMS, INC.) 17 September 2015 See paragraphs [0070]-[0078], [0110], [0143], [0184]-[0210], claim 11 and figures 4A, 7B, 9H, 14A, 15A.	1-20
A	WO 2013-094905 A1 (KOREA INSTITUTE OF MACHINERY & MATERIALS) 27 June 2013 See paragraphs [61]-[71] and figure 7.	1-20
A	US 2016-0290281 A1 (BRIGGS & STRATTON CORPORATION) 06 October 2016 See paragraphs [0021]-[0048] and figure 1.	1-20
A	US 2012-0039701 A1 (DIDDI et al.) 16 February 2012 See paragraphs [0021]-[0027] and figure 3.	1-20
A	US 2011-0289941 A1 (GONZALEZ SALAZAR et al.) 01 December 2011 See paragraphs [0031]-[0035] and figure 1.	1-20

 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

26 February 2018 (26.02.2018)

Date of mailing of the international search report

26 February 2018 (26.02.2018)

Name and mailing address of the ISA/KR

International Application Division

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2017/064074

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015-0260463 A1	17/09/2015	US 2017-0159495 A1 US 2017-0159496 A1 US 2017-0159497 A1 US 2017-0159498 A1 US 2017-0159499 A1 US 2017-0159500 A1 US 2017-0321967 A1 WO 2014-052927 A1	08/06/2017 08/06/2017 08/06/2017 08/06/2017 08/06/2017 08/06/2017 09/11/2017 03/04/2014
WO 2013-094905 A1	27/06/2013	KR 10-1345106 B1 KR 10-2013-0071099 A	26/12/2013 28/06/2013
US 2016-0290281 A1	06/10/2016	US 9803584 B2	31/10/2017
US 2012-0039701 A1	16/02/2012	CN 102374026 A EP 2420662 A1 JP 2012-041927 A RU 2011133554 A	14/03/2012 22/02/2012 01/03/2012 20/02/2013
US 2011-0289941 A1	01/12/2011	CA 2740259 A1 CN 102261272 A CN 102261272 B EP 2390475 A2 IL 212912 A JP 2011-246710 A JP 6055589 B2 KR 10-2011-0131125 A RU 2011121290 A RU 2562683 C2	28/11/2011 30/11/2011 25/11/2015 30/11/2011 31/07/2011 08/12/2011 27/12/2016 06/12/2011 10/12/2012 10/09/2015