Title: MICRO-TURBINE GAS GENERATOR AND PROPULSIVE SYSTEM

Fig. 6

Abstract: A propulsion system includes a first compressor in fluid communication with a fluid source. A first conduit is coupled to the first compressor, and a heat exchanger is in fluid communication with the first compressor via the first conduit. A second conduit is positioned proximal to the heat exchanger. A combustor is in fluid communication with the heat exchanger via the second conduit and is configured to generate a high-temperature gas stream. A third conduit is coupled to the combustor, and a first thrust augmentation device is in fluid communication with the combustor via the third conduit. The heat exchanger is positioned within the gas stream generated by the combustor.

[Continued on next page]
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:
02 November 2017 (02.11.2017)
A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - F02C 3/04, F02C 7/08 (2017.01)
CPC - F02C 3/04, F02C 3/05, F02C 7/08

B. MINIMUM DOCUMENTATION SEARCHED
See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US201 0/017,064/47 A1 (BERGEN) 06 May 2010 (06.05.2010), entire document, especially Fig 1-4; para [0016]-[0018], [0021], [0028]-[0029], [0033], [0035], [0037], [0046]-[0048]</td>
<td>9-13, 14-16</td>
</tr>
<tr>
<td>Y</td>
<td>US 2,469,439 A1 (LUNDQUIST) 10 May 1949 (10.05.1949), entire document, especially Fig 1-5; col 1, In 1-3; col 2, In 8-22, 26-38; col 4, In 67-75; col 5, In 1-20</td>
<td>1-8, 16</td>
</tr>
<tr>
<td>Y</td>
<td>US 2003/018,372 A1 (BEVILACQUA) 02 October 2003 (02.10.2003), entire document, especially Fig 1-2; para [0038]-[0039], [0041], [0043], [0045], [0047]</td>
<td>1-8</td>
</tr>
<tr>
<td>Y</td>
<td>US 2,626,501 A1 (PAVLECKA et al.) 27 January 1953 (27.01.1953), entire document, especially Fig 1-3; col 3, In 12-18, 32-38; col 6, In 3-30</td>
<td>14</td>
</tr>
<tr>
<td>Y</td>
<td>US 6/58,63 B31 (MOKKISUN) Ub July 2U4 (U6.U.2U4), entire document, especially Fig 1; col 3, In 65-67; col 4, In 1-3</td>
<td>4, 15</td>
</tr>
<tr>
<td>Y</td>
<td>US 201 1/009,4226 A1 (FINKENRATH et al.) 28 April 201 1 (28.04.2011), entire document, especially Fig 2; para [0029]-[0026]</td>
<td>6</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

Date of the actual completion of the international search: 05 July 2017
Date of mailing of the international search report: 15 SEP 2017

Name and mailing address of the ISA/US: Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-272-8300

Authorized officer: Lee W. Young
PCT Helpdesk: 571-272-4300
PCT DSP: 571-272-7774
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 6,918,244 B2 (DICKAU) 19 July 2005 (19.07.2005), entire document</td>
<td>1-16</td>
</tr>
</tbody>
</table>
INTERNATIONAL SEARCH REPORT

International application No. PCT/US 16/64827

Box No. I 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:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-8, directed to a propulsion system
Group II: Claim 9-16, directed to a combustor

—See Supplemental 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 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.

Form PCT/ISA/210 (continuation of first sheet (2)) (January 2015)
*** Continuation of Box No. III Observations where unity of invention is lacking ***

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

The invention of Group I includes the special technical feature of a first compressor in fluid communication with a fluid source; a first conduit coupled to the first compressor; a heat exchanger in fluid communication with the first compressor via the first conduit; a second conduit positioned proximal to the heat exchanger; a third conduit coupled to the combustor; and a first thrust augmentation device in fluid communication with the combustor via the third conduit, the heat exchanger being positioned within the gas stream generated by the combustor, not required by the claims of Group II.

The invention of Group II includes the special technical feature of a first toroidal casing circumscribing an axis and having an inlet configured to receive fluid, the first casing defining a first internal chamber in fluid communication with the inlet; a second toroidal casing disposed within the first internal chamber and circumscribing the axis, the second casing having an outer wall defining a second internal chamber, the outer wall having a plurality of orifices formed there through, the orifices providing fluid communication between the first and second chambers; a plurality of fuel injectors positioned to inject fuel into the second chamber through the orifices; and outlet structure defining at least one channel in fluid communication with the second chamber, the at least one channel being oriented parallel to the axis., not required by the claims of Group I.

COMMON TECHNICAL FEATURES

Groups I-II share the common technical features of a propulsion system including a combustor. However, this shared technical feature does not represent a contribution over prior art as being anticipated by US 4,222,234 A to Adamson, which discloses a propulsion system (10; Fig 1; col 3, ln 20-24) including a combustor (24; Fig 1; col 3, ln 37-39).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical features that would otherwise unify the groups.

Therefore, Groups I-II lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.