MONO-CYCLIC SWASHPLATE

An aircraft is provided and includes an airframe, a main rotor assembly operably disposed at an upper portion of the airframe to provide lift, a propulsor assembly operably disposed at a tail portion of the airframe to provide thrust and a control system. The control system includes a mono-cyclic swashplate assembly that is translatable in a translation direction to execute collective control of the propulsor assembly and rotatable about an axis defined transversely with respect to the translation direction to execute cyclic control of the propulsor assembly.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(*): B64C 27/605 (2016.01)
CPC: B64C 2072/7255, B64C 27/605.

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)

IPC(8): B64C 27/605 (2016.01)
CPC: B64C 2072/7255, B64C 27/605.

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

IPC(8): B64C 27/12 (2016.01)
CPC: B64C 27/12 USPC: 416/123, 416/170, 244/17.19

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

PatBase; PrQuest Dialog; Google Patents; Google Web; Google Scholar

Search Terms: swash, plate, counterrotat*, "counter rotat*", "counter-rotat *", "compound helicopter", rear, tail, empennage, aircraft, rotor*, craft*, gyrodyne, gyrodyne, helicopter

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>GB 1,18,17 A (DORNIER-WERKE G.m.b.H.). 26 June 1968 (26.06.1968). Fig. 1-2; p 3, ll 48-58; 79-96. 1 13-1 17; p 4, ll 40-49.</td>
<td>1, 3(1)</td>
</tr>
<tr>
<td>Y</td>
<td>US 7,413,142 B2 (Gmiyra). 19 August 2008 (19.08.2008). Fig. 1A; col 2, ll 54-56.</td>
<td>2, 3(2)</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

* 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 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: 03 January 2017

Date of mailing of the international search report: 23 JAN 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. 571-273-8300

Authorized officer: Lee W. Young

PCT Helpdesk: 971-272-4300
PCT O.S.P. 971-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)
INTERNATIONAL SEARCH REPORT

International application No. 
PCT/US 16/23151

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. 4-8, 15
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 J 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 1-3, directed to an aircraft having a propulsor coupled to a mono-cyclic swashplate assembly

Group II Claims 9-14, directed to a propulsor assembly including a propulsor gearbox housing, and a guide coupled to and restricted to travel through the gearbox housing.

-Continued on extra 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 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:

Group I requires the special technical features of an airframe and a main rotor assembly operably disposed at an upper portion of the airframe to provide lift, not required by Group II.

Group II requires the special technical features of a propulsor gearbox housing, and a guide coupled to and restricted to travel along the gearbox housing, not required by Group I.

The only technical features shared by Groups I and II that would otherwise unify the Groups are an aircraft, having a propulsor coupled to a mono-cyclic swashplate assembly that is translatable in a translation direction to execute collective control of the propulsor assembly. However, these shared technical features do not represent a contribution to the prior art because they are anticipated by US 5,096,140 to Dornier, Jr., deceased et al. (hereinafter "Dornier").

Dornier teaches an aircraft (represented by fuselage 1 in Figs. 1a-1c; col 4, ln 66) having a propulsor assembly (blade 3a on engine/hub 3 in Figs. 5b-5c; col 7, ln 48) having a propulsor assembly (blade 3a on engine/hub 3 in Figs. 5b-5c; col 7, ln 48) that is translatable in a translation direction to provide both lift and translational thrust to the aircraft - col 5, in 3-23) coupled to a mono-cyclic swashplate (3d-3d' in Figs. 5b-5c; col 5, in 3-23 - a mono-cyclic swashplate is understood to be a swashplate which is configured for pivoting movement about a single axis that extends perpendicular to a direction of translation), wherein the swash plate is translatable (e.g., from position 3d to position 3d' in Fig. 5b; col 5, in 17-32) in a translation direction to execute collective control of the assembly (col 5, In 17-32).

As these common technical feature(s) of Groups I-II were known in the art at the time of the invention, it cannot be considered a special technical feature that would otherwise unify Groups I-II.

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