

PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing (day/month/year)	22.05.2018
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Applicant's or agent's file reference NIAC0097W1	FOR FURTHER ACTION See paragraph 2 below
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International application No. PCT/JP2018/006765	International filing date (day/month/year) 23.02.2018	Priority date (day/month/year) 31.03.2017
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International Patent Classification (IPC) or both national classification and IPC
B64G1/64 (2006.01) i

Applicant
IHI AEROSPACE CO., LTD.

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/JP	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established 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)).
2. This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. forming part of the international application as filed:
 - in the form of an Annex C/ST.25 text file.
 - on paper or in the form of an image file.
 - b. furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. furnished subsequent to the international filing date for the purposes of international search only:
 - in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4. In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	1-5	YES
	Claims		NO
Inventive step (IS)	Claims	5	YES
	Claims	1-4	NO
Industrial applicability (IA)	Claims	1-5	YES
	Claims		NO
2. Citations and explanations:			
<p>Document 1: JP 2017-508671 A (BOEING CO.) 30 March 2017, paragraphs [0022]-[0028], [0105]-[0138], fig. 1-3, 5-11 & US 2015/0266595 A1 & WO 2015/142390 A1, specification, page 6, line 31 to page 8, line 3; page 20, line 1 to page 25, line 12; fig. 1-3, 5-11 & CN 106132832 A</p> <p>Document 2: US 5364046 A (ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN) 15 November 1994, column 3, line 67 to column 4, line 21; column 7, lines 37-55; fig. 1, 6 (Family: none)</p> <p>Document 3: JP 8-251947 A (HITACHI, LTD.) 27 September 1996, abstract, fig. 1 (Family: none)</p> <p>Document 4: JP 2004-350388 A (HONDA MOTOR CO., LTD.) 09 December 2004, abstract, fig. 2 (Family: none)</p> <p style="margin-top: 20px;">The invention as in claim 1 does not involve an inventive step in light of documents 1 and 2 cited in the ISR.</p> <p style="margin-left: 40px;">Document 1 (paragraphs [0022]-[0028], [0105]-[0138], fig.</p>			

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1-3, 5-11) describes a docking device (108, 210, 500, 700) that is mounted on one space vehicle (106) flying by inertia through outer space and that couples the one space vehicle to another space vehicle (107) flying by inertia through outer space, wherein the docking device is provided with a base ring (703) disposed at the coupling part of the one space vehicle; a one-side capturing ring (701) that comes into contact with the other space vehicle; six links (fig. 7-11, elongate members 902, 904, etc.) that constitute a parallel link mechanism (705) that couples the base ring and the one-side capturing ring by means of six degrees of freedom; and a linear actuator (325, 504, 600, 705) that has a motor (318, 602) embedded therein as a drive source and causes the links to advance and retreat; wherein, there is provided a resistance generation mechanism (brake 604) that, at the time that the other space vehicle comes into contact with the one-side capturing ring and the links receive a contact load (fig. 9, 900), causes a resistance force against a compressive load to be generated in the motor of the linear actuator.

Document 2 (column 3, line 67 to column 4, line 21; column 7, lines 37-55; fig. 1, 6) describes a docking device provided with a resistance generation mechanism (dynamic braking) that causes a regenerative current to be generated in a motor (the motor driven pinion gear 273) of a linear actuator (271, 273) to produce a resistance force against a compressive load (the closing velocity).

The inventions described in documents 1 and 2 both produce a resistance force against a compressive load in a docking device; therefore, a person skilled in the art could easily conceive of adopting the resistance generation mechanism that causes a regenerative current to be generated in a motor to produce a resistance force as described in

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document 2, as the resistance generation mechanism of the invention described in document 1.

The invention as in claim 2 does not involve an inventive step in light of documents 1 and 2 cited in the ISR.

Document 1 (paragraphs [0114]-[0117]) describes a sliding screw that rotates and moves back and forth in the axial direction of the links due to the output of the motor of the linear actuator, and that rotates in the direction for loosening the axial force of the links and moves back and forth in the axial direction of the links at the time that the links receive the contact load.

Moreover, the links bear tensile loads in the drive direction of the motor, and in this case, no resistance force is generated because no regenerative current is generated.

The invention as in claim 3 does not involve an inventive step in light of documents 1, 2 or 3 cited in the ISR.

The use of a PWM control circuit for controlling, with pulse width modulation, a regenerative current produced in the motor is a well-known feature as described, for example, in the abstract and fig. 1 of document 3.

The invention as in claim 4 does not involve an inventive step in light of documents 1, 2 or 4 cited in the ISR.

Providing a bridge circuit including four FETs and generating the regenerative current by selectively opening and closing the gates of the four FETs is a well-known feature as described, for example, in the abstract and fig. 2 of document 4.

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The invention as in claim 5 is not described in any of documents 1-4 cited in the ISR and would not be obvious to a person skilled in the art, and therefore, is novel and involves an inventive step.

In particular, the fact that a bridge circuit includes a PWM control circuit that is used by selectively opening and closing the gates of the four FETs is not disclosed in any document including documents 1-4 cited in the ISR.