

**PATENT COOPERATION TREATY**

**PCT**

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 2461500PCT	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. PCT/US2016/064023	International filing date ( <i>day/month/year</i> ) 29 November 2016 (29.11.2016)	Priority date ( <i>day/month/year</i> ) 30 November 2015 (30.11.2015)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant LUMEDYNE TECHNOLOGIES INCORPORATED			

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																								
<p>3. This report contains indications relating to the following items:</p> <table> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input checked="" type="checkbox"/>	Box No. VIII	Certain observations on the international application
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<input checked="" type="checkbox"/>	Box No. VIII	Certain observations on the international application																						

	Date of issuance of this report 05 June 2018 (05.06.2018)
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# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

# PCT

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY  
(PCT Rule 43bis.1)**

To:

see form PCT/ISA/220

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

**FOR FURTHER ACTION**  
See paragraph 2 below

International application No.  
PCT/US2016/064023

International filing date (day/month/year)  
29.11.2016

Priority date (day/month/year)  
30.11.2015

International Patent Classification (IPC) or both national classification and IPC  
INV. G01C19/5776 G01C21/16 G01P15/08

Applicant  
LUMEDYNE TECHNOLOGIES INCORPORATED

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 and 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 usually 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:



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Date of completion of this opinion

see form  
PCT/ISA/210

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**Box No. I Basis of the opinion**

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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**

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1. Statement

Novelty (N)	Yes: Claims	<u>2-13, 16-27</u>
	No: Claims	<u>1, 14, 15, 28</u>
Inventive step (IS)	Yes: Claims	
	No: Claims	<u>1-28</u>
Industrial applicability (IA)	Yes: Claims	<u>1-28</u>
	No: Claims	

2. Citations and explanations

see separate sheet

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**Re Item VIII**

**Certain observations on the international application**

**Clarity of the claims**

1. Claims 1 and 15

1.1 Claim 1 describes an inertial sensor comprising a certain number of circuits for producing an output signal corresponding to an inertial parameter to be measured.

On the other hand, the description mentions as a problem to be solved the control of drift of the sensor, the drift being an error in the output which is due to external perturbations such as changes in the structure of the sensor due to temperature, pressure, mechanical creep... (see paragraphs 3 and 4), wherein such drift compromises low-frequency performances due to low-frequency noise (1/f noise).

This is however not clear how such a problem can be solved by the circuits mentioned in claim 1. The description does not explain how these circuits influence the drift in the output of the sensor.

There seems to be some essential elements missing in the claim in order to make apparent how the problem mentioned above is solved.

1.2 The same comment as above applies also, *mutatis mutandis*, to the corresponding independent claim 15 (method for determining an inertial parameter of an inertial sensor).

2. Claims 3 and 17

2.1 Claim 3 defines a second inertial sensor on a different substrate. It is not clear what the substrate is referring to. No substrate is defined previously. Further, it is not clear whether this second inertial sensor is part of the inertial sensor previously defined or if it is another entity, thereby rendering the scope of the claim unclear.

2.2 The same applies, *mutatis mutandis*, to the corresponding dependent method claim 17.

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1 Cited documents**

Reference is made to the following documents:

- D1: US 3 925 642 A (ROANTREE JAMES P ET AL) 9 December 1975  
(1975-12-09)
- D2: US 2011/041601 A1 (HSU YING [US] ET AL) 24 February 2011  
(2011-02-24)
- D3: US 5 561 400 A (IGUCHI YUTAKA [JP] ET AL) 1 October 1996  
(1996-10-01)

**2 Novelty and inventive step**

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1 and 15 is not new in the sense of Article 33(2) PCT.

**2.1 Independent claims 1 and 15**

2.1.1 The document D1 discloses an inertial sensor for determining an inertial parameter (cf. col. 1 l. 16-25), the inertial sensor comprising:

- a window circuit configured for receiving an input pulse stream based on the inertial parameter (cf. col. 3 l. 45-50) and selecting a portion of the input pulse stream (cf. fig. 2, ref. 34: the pulse multiplier selects a portion of the input pulses corresponding to a selected time interval, see col. 3 l. 45-50, and multiply them);
- an exclusive-or circuit configured for combining, using an exclusive-or operation, the selected portion with a reference pulse stream to produce a combined pulse stream (cf. fig. 2, ref. 42);
- a counter circuit configured for incrementing a count based on the combined pulse stream (cf. fig. 2, ref. 52);
- a scaling circuit configured for scaling the incremented count to produce an output

signal corresponding to the inertial parameter (cf. fig. 2, ref. 62 and col. 5 l. 1-18: it is clear that the output being proportional to drift implies scaling to access the drift value).

Therefore, the subject-matter of claim 1 is not new.

Moreover, the same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claim 15 (method for determining an inertial parameter), which therefore is also considered as lacking novelty over D1.

2.1.2 Additionally, the document D2 discloses also an inertial sensor for determining an inertial parameter (cf. par. 4), the inertial sensor comprising:

- a window circuit configured for receiving an input pulse stream based on the inertial parameter and selecting a portion of the input pulse stream (cf. par. 110, fig. 3 "COUNTER 1");
- a counter circuit configured for incrementing a count based on the selected pulse stream (cf. fig. 3, "COUNTER 2");
- a scaling circuit configured for scaling the incremented count to produce an output signal corresponding to the inertial parameter (implicit: cf. par. 41).

The subject-matter of claim 1 therefore differs from this known sensor in that an exclusive-or circuit configured for combining, using an exclusive-or operation, the selected portion with a reference pulse stream to produce a combined pulse stream.

In combination with the remark made under ITEM VIII above, it is however not clear which technical effect is provided by such a difference and consequently which problem is to be solved by the sensor of claim 1.

Therefore, the subject-matter of claim 1 (and respectively claim 15) is also considered not inventive over D2.

2.1.3 Furthermore, the same remark as in section 2.1.2 above can be made based on document D3 which discloses also an inertial sensor (col. 1 l. 5, 6) comprising a window circuit (see fig. 1, ref. 41, 48, fig. 7: signal SK is a portion of a signal selected over a time interval  $\Delta T$ ), a counter circuit (fig. 1, ref. 49) and a scaling circuit (considered implicit).

## 2.2 Dependent claims

Concerning claims 14 and 28, a gyroscope for measuring angular velocity as an inertial parameter is further known from D1 (see col. 3 l. 57-60). This principle of operation could as well be adapted to acceleration sensing, as described in claims 13 and 27.

The use of a resonator for the inertial sensor, as claimed in claims 2 and 16 is known from D2 (fig. 1) or D3 (fig. 3a).

The other dependent claims describe further implementation details of the circuit, for which it is not really possible for now to judge on their inventive merit because of the lack of clarity mentioned in item VIII here above, they will be considered for the time being as not inventive because of lacking any proper technical effect.