

**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 FQI-127WO	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. PCT/US2016/019693	International filing date ( <i>day/month/year</i> ) 26 February 2016 (26.02.2016)	Priority date ( <i>day/month/year</i> ) 06 March 2015 (06.03.2015)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant FLUID-QUIP, INC.			

<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 5 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 checked="" 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 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 checked="" 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 type="checkbox"/>	Box No. VIII	Certain observations on the international application
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<input type="checkbox"/>	Box No. VIII	Certain observations on the international application																						

<p align="center">The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. +41 22 338 82 70</p>	<p>Date of issuance of this report 12 September 2017 (12.09.2017)</p>
	<p>Authorized officer</p> <p align="center"><b>Kihwan Moon</b></p> <p>e-mail: pct.team1@wipo.int</p>

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To: RANDALL S. JACKSON  
WOOD, HERRON & EVANS, LLP  
2700 CAREW TOWER  
441 VINE STREET  
CINCINNATI, OH 45202-2917

**PCT**

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year) **28 APR 2016**

Applicant's or agent's file reference  
FQI-127WO

**FOR FURTHER ACTION**  
See paragraph 2 below

International application No.  
PCT/US2016/019693

International filing date (day/month/year)  
26 February 2016

Priority date (day/month/year)  
06 March 2015

International Patent Classification (IPC) or both national classification and IPC  
IPC(8) - F15D1/10 (2016.01)  
CPC - F15D1/10 (2016.02)

Applicant  
FLUID-QUIP, INC.

## 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 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/  
Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450, Alexandria, VA 22313-1450  
Facsimile No. 571-273-8300

Date of completion of this opinion  
**19 April 2016**

Authorized officer  
**Blaine R. Copenheaver**  
PCT Helpdesk: 571-272-4300  
PCT OSP: 571-272-7774

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2016/019693

## 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 43*bis*.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 13*ter*.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 13*ter*.1(a)).
    - on paper or in the form of an image file (Rule 13*ter*.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:

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2016/019693

## Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

the entire international application.

claims Nos. 5-12

because:

the said international application, or the said claims Nos. \_\_\_\_\_ relate to the following subject matter which does not require an international search (*specify*):

the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 5-12 are so unclear that no meaningful opinion could be formed (*specify*):

Claim 5-12 are improper multiple dependent claims not drafted in accordance with the second and third sentences of Rule 6.4(a).

the claims, or said claims Nos. \_\_\_\_\_ are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

no international search report has been established for said claims Nos. 5-12

a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

furnish a sequence listing in the form of an Annex C/ST.25 text file, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.

furnish a sequence listing on paper or in the form of an image file complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.

pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a) or (b).

See Supplemental Box for further details.

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2016/019693

**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**

## 1. Statement

Novelty (N)	Claims	<u>1-4, 13-17</u>	YES
	Claims	<u>None</u>	NO
Inventive step (IS)	Claims	<u>1-4, 13-17</u>	YES
	Claims	<u>None</u>	NO
Industrial applicability (IA)	Claims	<u>1-4, 13-17</u>	YES
	Claims	<u>None</u>	NO

## 2. Citations and explanations:

Claims 1-4 and 13-17 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest:

[Claim 1] A liquid treatment apparatus for processing a liquid, comprising: an inlet nozzle including an orifice for directing a flow of liquid fluid through the orifice to define a fluid jet; and a conical diffuser including a tip, a base portion, and a curved surface therebetween, wherein the conical diffuser is generally aligned with the orifice such that the fluid jet impacts upon the tip of the conical diffuser, and wherein the curvature of the curved surface is selected to maintain a substantially constant Froude number of the liquid along the conical diffuser.

Regarding Claim 1, Zaslavsky discloses a liquid treatment apparatus (hydro/aero-power generation tower 10 comprising spray system 20, Fig. 1) for processing a liquid (Spray system 20, receiving water through pumped storage and/or other unique supply means described more fully below, sprays water droplets 22 over the cross-sectional area of duct 14, para. [0127]), comprising: an inlet nozzle (inlet 16, Fig. 1) including an orifice (spray system 20, Fig. 1) for directing a flow of liquid fluid through the orifice to define a fluid jet (spray system 20 ... sprays water droplets 22 over the cross-sectional area of duct 14, preferably at the upper portion of tower 10 in the proximity of inlet 16, para. [0127]); and

a conical diffuser (diffuser 68 comprising inner conic section 80, Fig. 1) including a tip (shown at top portion of conic section 80 in Fig. 1), a base portion (base portion shown at bottom portion of conic section 80 in Fig. 1), and a curved surface therebetween (see Fig. 1 showing inner conic section 80 having a curved surface between its top and bottom portions), wherein the conical diffuser is generally aligned with the orifice such that the fluid jet impacts upon the tip of the conical diffuser (inner conic section 80 helps to optimize the efficiency of tower 10 by providing a central aerodynamic structure to direct the downdraft toward outlet 18 and maintaining a substantially constant cross-sectional area for the air to flow through, para. [0353]).

Zaslavsky does not disclose wherein the curvature of the curved surface is selected to maintain a substantially constant Froude number of the liquid along the conical diffuser.

It would not have been obvious to one of ordinary skill in the art at the time the invention was made to provide the limitations of claim 1 with the apparatus of Zaslavsky because such an arrangement of parts is not in the prior art and providing such an arrangement would require more than ordinary skill in the art to achieve.

Claims 2-4 depend from claim 1, and therefore meet the criteria set out in PCT Article 33(2)-(3) for at least the reasons set forth above with respect to claim 1.

[Claim 13] A method of treating a liquid, comprising: directing a flow of liquid through an orifice to define a fluid jet; impacting the fluid jet upon a conical diffuser having a tip, a base portion, and a curved surface therebetween; and maintaining a substantially constant Froude number as the liquid flows from the tip toward the base portion of the conical diffuser.

Regarding Claim 13, Zaslavsky discloses a method of treating a liquid (hydro/aero-power generation tower 10 comprising spray system 20, Fig. 1), comprising: directing a flow of liquid through an orifice (inlet 16 comprising spray system 20, Fig. 1) to define a fluid jet (Spray system 20, receiving water through pumped storage and/or other unique supply means described more fully below, sprays water droplets 22 over the cross-sectional area of duct 14, para. [0127]);

impacting the fluid jet upon a conical diffuser (diffuser 68 comprising inner conic section 80, Fig. 1) having a tip (tip shown at top portion of conic section 80 in Fig. 1), a base portion (base portion shown at bottom portion of conic section 80 in Fig. 1), and a curved surface therebetween (see Fig. 1 showing inner conic section 80 having a curved surface between its top and bottom portions). Zaslavsky does not disclose maintaining a substantially constant Froude number as the liquid flows from the tip toward the base portion of the conical diffuser.

It would not have been obvious to one of ordinary skill in the art at the time the invention was made to provide the limitations of claim 13 with the method of Zaslavsky because such an arrangement of parts is not in the prior art and providing such an arrangement would require more than ordinary skill in the art to achieve.

Claims 14-17 depend from claim 13, and therefore meet the criteria set out in PCT Article 33(2)-(3) for at least the reasons set forth above with respect to claim 13.

Claims 1-4 and 13-17 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.