PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	LICENSE

CONVEYING PARTY DATA

Name	Execution Date
Oxygenator Water Technologies, Inc.	10/04/2012
Aqua Innovations Incorporated	10/04/2012

RECEIVING PARTY DATA

Name:	Roy H Lecy
Street Address:	2640 North Saunders Lake Drive
City:	Minnetrista
State/Country:	MINNESOTA
Postal Code:	55364

PROPERTY NUMBERS Total: 3

Property Type	Number
Patent Number:	6689262
Patent Number:	7396441
Patent Number:	7670495

CH $120.00 6689262

CORRESPONDENCE DATA

Fax Number: 6123376100
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 6123376100
Email: nathanbrandenburg@siegelbrill.com
Correspondent Name: Nathan M. Brandenburg
Address Line 1: 100 Washington Avenue South
Address Line 2: Suite 1300
Address Line 4: Minneapolis, MINNESOTA 55401

ATTORNEY DOCKET NUMBER:	26141-001
NAME OF SUBMITTER:	Nathan M. Brandenburg

Signature:	/nathanmbrandenburg/
Date:	04/30/2013
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 35
source=OWT - Aqua License#page1.tif
source=OWT - Aqua License#page2.tif
source=OWT - Aqua License#page3.tif
source=OWT - Aqua License#page4.tif
source=OWT - Aqua License#page5.tif
source=OWT - Aqua License#page6.tif
source=OWT - Aqua License#page7.tif
source=OWT - Aqua License#page8.tif
source=OWT - Aqua License#page9.tif
source=OWT - Aqua License#page10.tif
source=OWT - Aqua License#page11.tif
source=OWT - Aqua License#page12.tif
source=OWT - Aqua License#page13.tif
source=OWT - Aqua License#page14.tif
source=OWT - Aqua License#page15.tif
source=OWT - Aqua License#page16.tif
source=OWT - Aqua License#page17.tif
source=OWT - Aqua License#page18.tif
source=OWT - Aqua License#page19.tif
source=OWT - Aqua License#page20.tif
source=OWT - Aqua License#page21.tif
source=OWT - Aqua License#page22.tif
source=OWT - Aqua License#page23.tif
source=OWT - Aqua License#page24.tif
source=OWT - Aqua License#page25.tif
source=OWT - Aqua License#page26.tif
source=Agreement of Strict Foreclosure (signed)#page1.tif
source=Agreement of Strict Foreclosure (signed)#page2.tif
source=Agreement of Strict Foreclosure (signed)#page3.tif
source=Agreement of Strict Foreclosure (signed)#page4.tif
source=Agreement of Strict Foreclosure (signed)#page5.tif
source=Agreement of Strict Foreclosure (signed)#page6.tif
source=Agreement of Strict Foreclosure (signed)#page7.tif
source=Agreement of Strict Foreclosure (signed)#page8.tif
source=License Amendment - Signed#page1.tif

License Agreement

THIS AGREEMENT ("Agreement") is entered into this 30th day of July, 2008 (the "Effective Date"), by and between Oxygenator Water Technologies, Inc., a Minnesota corporation with offices at 6101 Baker Rd., #206, Minnetonka, Minnesota, 55435 ("Licensor") and Aqua Innovations, Inc. a Minnesota corporation with offices at 6101 Baker Rd., #206, Minnetonka, Minnesota, 55435 ("Licensee", and Licensor and Licensee each a "Party" and together the "Parties"). Initially capitalized terms defined in this Agreement shall have the meaning ascribed to them respectively herein.

WITNESSETH:

LICENSOR owns the technology for which patents have been issued and are pending with respect to electrolytic hydrolysis of water to increase its dissolved oxygen content. A more complete description of said technology, together with a description of the patents issued and currently pending for said technology, is set forth in Article 1 below and in Exhibit "A" attached hereto.

LICENSOR anticipates and intends that it will make additional discoveries and improvements to said technology, some of which may be patentable.

It is further anticipated by the parties that LICENSOR may make improvements to said technology and additional discoveries concerning other applications for said technology.

The parties desire that LICENSOR grant a perpetual, exclusive license to LICENSEE to develop and sell throughout the world certain products utilizing the technology LICENSOR has developed and may in the future develop, all according to the terms and conditions set forth in this Agreement.

The parties further desire that LICENSOR will retain the complete and entire right to develop and sell throughout the world in markets not licensed to LICENSEE hereunder products utilizing the technology LICENSOR has developed and may in the future develop or the technology that LICENSEE may develop in the future, also according to the terms and conditions set forth in this Agreement.

Thus, the parties have agreed to enter into a licensing arrangement by which each party will be entitled to benefit from the other party's patents, technology and know-how concerning electrolytic hydrolysis of water in the sale of products in certain markets.

NOW, THEREFORE, based on the foregoing and the mutual covenants and agreements herein contained, the parties hereby covenant and agree as follows:

EXHIBIT "B"

LICENSEE Markets

All worldwide markets for:

- Waste Water Treatment
- Medical Applications
- Sport Fishing
- Aqua Culture
- Horticulture (consumer and commercial)
- Hydroponics

Markets excluded from license agreement (including but not limited to):

- Water Treatment (all applications except waste water)
- Fermentation
- Desalination
- Human Nutrition
- Animal Nutrition

ARTICLE 1
DEFINITIONS

When used in this Agreement, the following terms have the meanings set forth below unless a different and common meaning of the term is clearly indicated by the context, and variants and derivatives of the following terms shall have correlative meanings:

"***Agreement***" has the meaning set forth in the preamble.

"***LICENSOR Documents***" has the meaning set forth in Section 2.6.

"***LICENSOR Improvements***" means all developments LICENSOR may make in the LICENSOR Technology or the LICENSEE Technology prior to the termination of this Agreement, whether or not patentable, and which are invented, developed, discovered or otherwise acquired by LICENSOR and which LICENSOR may lawfully communicate to LICENSEE.

"***LICENSOR Markets***" means all uses for the LICENSOR Technology and the LICENSEE Technology other than in the LICENSEE Markets.

"***LICENSOR Patents***" means all of LICENSOR's patents (whether issued to LICENSOR or controlled by license rights or otherwise and whether such rights are held alone or jointly with others, and patents pending now, or during the term of this Agreement, issued to LICENSOR (by any country) relating to the LICENSOR Technology, including, but not limited to, those patents and those patents pending described on Exhibit A and any continuations, continuations-in-part, divisions, registrations, confirmations, reissues, renewals or extensions of term thereof.

"***LICENSOR Products***" means any product manufactured and/or sold or distributed by LICENSOR or a sub licensee of LICENSOR under any claim contained in the LICENSEE Patents.

"***LICENSOR Property***" means LICENSOR Patents, LICENSOR Improvements and LICENSOR Technology.

"***LICENSOR Technology***" means LICENSOR's unpatented technology and information now existing and relating to, and embodying LICENSOR's experience in electrolytic hydrolysis of water. LICENSOR Technology shall include the technical information in all current and future manuals, formulae, specifications, test data and procedures, flow charts, apparatus plans, drawings, designs and other information actually communicated by LICENSOR to LICENSEE during the term of this Agreement, whether contained in documentary form, electronic medium or communicated as a result of LICENSOR imparting the same directly or giving LICENSEE access to any of LICENSOR's production facilities.

"***Effective Date***" has the meaning set forth in the preamble.

"***LICENSEE Documents"*** has the meaning set forth in Section 2.7.

"***LICENSEE Improvements***" means all developments LICENSEE may make in the LICENSOR Technology or the LICENSEE Technology prior to the termination of this Agreement, whether or not patentable and which are invented, developed, discovered or otherwise acquired by LICENSEE and which LICENSEE may lawfully communicate to LICENSOR.

"***LICENSEE Markets***" means those markets for Licensee Products as are described in Exhibit B attached hereto.

"***LICENSEE Patents***" means all of LICENSEE's patents (whether issued to LICENSEE or controlled by license rights or otherwise and whether such rights are held alone or jointly with others) which may after the effective date of this Agreement be issued (by any country) relating to electrolytic hydrolysis of water and any continuations, continuations-in-part, divisions, registrations, confirmations, reissues, renewals or extensions of term thereof.

"***LICENSEE Products***" means any product manufactured and/or sold or distributed to any party other than LICENSOR by LICENSEE or a sublicense of LICENSEE in conformity with the terms of this Agreement, including, but not limited to, any product which is based on any claim or thing contained in any LICENSOR Property.

"***LICENSEE Property***" means LICENSEE Patents, LICENSEE Improvements and LICENSEE Technology.

"***LICENSEE Technology***" means LICENSEE's unpatented technology and information which LICENSEE may develop relating to, and embodying LICENSEE's experience in, the manufacturing, the processing, quality control, and sale of the LICENSEE Products. LICENSEE Technology shall include the technical information in all manuals, formulae, specifications, test data and procedures, flow charts, apparatus plans, drawings, designs and other information actually communicated by LICENSEE to LICENSOR during the term of this Agreement, whether contained in documentary form, electronic medium or communicated as a result of LICENSEE imparting the same directly or giving LICENSOR access to any of LICENSEE's production facilities.

"***Territory***" means the world.

ARTICLE 2
MARKETS AND LICENSING

2.1. Exclusive Markets. The parties agree that unless properly terminated by LICENSOR pursuant to Section 5.1 below, LICENSEE will have the exclusive right to exploit the LICENSOR Property and the LICENSEE Property in the manufacture, use and sale or other distribution of LICENSEE Products in the LICENSEE Markets in the Territory. The parties further agree that LICENSOR will have the exclusive right to exploit the LICENSOR Property and the LICENSEE Property in the manufacture, use and sale or other distribution of LICENSOR Products in the LICENSOR Markets in the Territory. LICENSEE may not, directly or indirectly, distribute in any manner any product which competes with the LICENSEE Products in any manner nor may LICENSEE assist or have any interest in any third party distributing any such products through licensing or assignment of technology to any such third party or by any other means.

2.2. Exclusive License to LICENSEE. Subject to the terms and conditions of this Agreement, LICENSOR hereby confers upon LICENSEE the sole and exclusive license, with the right of sublicense, under the LICENSOR Property, to make, have made, use and sell the LICENSEE Products in the LICENSEE Markets in the Territory and to prevent infringement of the LICENSOR Patents, and to prevent unauthorized use and disclosure of the LICENSOR Technology in connection therewith. No license is conferred hereby to make, have made, use and sell articles which are not LICENSEE Products.

2.3. Exclusive License to LICENSOR. Subject to the terms and conditions of this Agreement, LICENSEE hereby confers upon LICENSOR the sole and exclusive, royalty-free license, with the right of sublicense, under the LICENSEE Property, to make, have made, use and sell the LICENSOR Products in the LICENSOR Markets in the Territory and to prevent infringement of the LICENSEE Patents, and to prevent unauthorized use and disclosure of the LICENSEE Technology in connection therewith. No license is conferred hereby to make, have made, use and sell articles which are not LICENSOR Products.

2.4. Product Markings. The Parties shall insure that all LICENSOR Products and all LICENSEE Products are marked with any applicable patent number and all labeling and other product information shall be marked in such manner as to conform with the patent laws and practices of the country of sale.

2.5 Transfer of Technology by LICENSOR. As promptly as practicable after the execution of this Agreement, LICENSOR shall deliver to LICENSEE all information concerning the LICENSOR Property. LICENSOR also promptly shall deliver to LICENSEE all future information it acquires concerning the LICENSOR Property. All documentary information so delivered or any documentary information following non-documentary disclosure by LICENSOR, shall be referred to as "LICENSOR Documents". LICENSEE shall receive, use, maintain, restrict access to or copying of, and safeguard the LICENSOR Documents in such manner as to maximize the value of the LICENSOR Patents, the LICENSOR Technology and the LICENSOR Improvements; without limiting the generality of the foregoing, LICENSEE shall, and shall cause its employees and

representatives to, use reasonable care to prevent unauthorized access to, copying, use, publication, disclosure or other dissemination of the LICENSOR Documents. Upon 10 days advance notice and at reasonable times, LICENSOR shall permit LICENSEE access to its technical personnel at its offices or at such locations as is mutually agreed upon by the Parties. During such visits, technically competent personnel will be provided by LICENSOR to answer fully such questions as LICENSEE may have with a view to transferring the LICENSOR Property. Nothing in this Section 2.6 shall require LICENSOR to disclose to LICENSEE any technological information which it does not own or that is otherwise subject to restrictions on use or disclosure.

2.6. Transfer of Technology by LICENSEE. As promptly as practicable after LICENSEE develops, discovers or otherwise comes into possession of LICENSEE Patents, LICENSEE Improvements and/or LICENSEE Technology, LICENSEE shall deliver to LICENSOR all information concerning same. All documentary information so delivered or any documentary information following non-documentary disclosure by LICENSEE, shall be referred to as "LICENSEE Documents." LICENSOR shall receive, use, maintain, restrict access to or copying of, and safeguard the LICENSEE Documents in such manner as to maximize the value of the LICENSEE Patents, the LICENSEE Technology and the LICENSEE Improvements; without limiting the generality of the foregoing, LICENSOR shall, and shall cause its employees and representatives to, use reasonable care to prevent unauthorized access to, copying, use, publication, disclosure or other dissemination of the LICENSEE Documents. Upon 10 days advance notice and at reasonable times, LICENSEE shall permit LICENSOR access to its technical personnel at its offices or at such locations as is mutually agreed upon by the Parties. During such visits, technically competent personnel will be provided by LICENSEE to answer fully such questions as LICENSOR may have with a view to transferring to LICENSOR the LICENSEE Property. Nothing in this Section 2.7 shall require LICENSEE to disclose to LICENSOR any technological information which it does not own or that is otherwise subject to restrictions on use or disclosure.

2.7. Further Prosecution of Patents. LICENSOR will continue with the prompt prosecution of all pending patent applications filed by LICENSOR as detailed on Schedule "A", so long as it is commercially reasonable to do so, and LICENSOR will periodically advise LICENSEE of the status of such prosecutions. As soon as practical, the Parties will confer to determine the countries for which the Parties desire protection for the LICENSOR Patents. In the event that LICENSEE files an application for a patent(s) covering electrolytic hydrolysis of water, LICENSEE will periodically advise LICENSOR of the status of the prosecution of any such patent. As soon as practical after any such application by LICENSEE, the Parties will confer to determine the countries for which the Parties desire protection for the LICENSEE Patents. From the date of this Agreement, all expenses incurred in filing for and maintaining protection in those countries mutually agreed upon (other than expenses of prosecuting the original patent application in the first jurisdiction, which will be the responsibility of the Party filing the patent application) will be shared equally by the Parties. Either Party may seek protection in any country not mutually agreed upon by paying the full amount of the cost thereof. A party seeking such additional protection will receive the full cooperation of the other Party (other than in paying the expenses thereof) in protecting all patents in any such other country.

2.8. Additional Covenants. Each of LICENSOR and LICENSEE shall faithfully comply with their respective obligations under this Agreement and shall incorporate all terms and conditions required by this Agreement in any contracts with third parties to whom access to the LICENSOR Property or the LICENSEE Property, as the case may be, may (but only in accordance with this Agreement) be given. Each of LICENSOR and LICENSEE shall indemnify and hold harmless the other Party and its successors and assigns from any injury, loss, or damage of any kind or nature, or any other liability sought to be imposed on such Party, and arising out of or in connection with or resulting from the marketing, sale or use of the imdemnifying Party's product(s), including any advertising or other promotional activities related thereto.

2.9. Infringement Actions. Neither LICENSOR nor LICENSEE will have any responsibility to the other Party for any damage or expense incurred by such other Party which arises from any action, claim or cause of action brought by any person as the result of any alleged patent infringement or trade secret misappropriation by reason of such other Party's manufacture, use or sale of any product under any of the licenses conferred hereby.

2.10. LICENSEE's Rights in Event of Third Party Infringement. LICENSEE shall have the right, in LICENSOR's name (if required by law, otherwise, in LICENSEE's name) but at LICENSEE's sole expense, to sue third parties in the LICENSEE Markets for infringements of the LICENSOR Patents and misappropriation of the LICENSOR Technology and unpatented LICENSOR Improvements, and LICENSOR shall, but at LICENSEE's expense for LICENSOR's direct associated expenses, fully and promptly cooperate and assist LICENSEE in connection with any such suit. LICENSEE shall promptly reimburse LICENSOR for said suit-associated direct expenses upon presentation of LICENSOR's itemized statement therefor. LICENSOR may, if it so elects, join in any such suit as a plaintiff. All damages, awards or settlement proceeds in such suit shall be LICENSEE's. If LICENSEE, after notice from LICENSOR of an alleged infringement or misappropriation, shall within 90 days fail to institute suit, LICENSOR, in its own name (or, if required by law, in its and LICENSEE's name) and at its own expense, may sue therefore, and LICENSEE shall, but at LICENSOR's expense for LICENSEE's direct associated expenses, fully and promptly cooperate and assist LICENSOR in connection with any such suit. LICENSOR shall promptly reimburse LICENSEE for said suit-associated direct expenses upon presentation of LICENSEE's itemized statement therefor. All damages, awards or settlement proceeds in such suit shall be LICENSOR's.

2.11. LICENSOR's Rights in Event of Third Party Infringement. LICENSOR shall have the right, in LICENSEE's name (if required by law, otherwise, in LICENSOR's name) but at LICENSOR's sole expense, to sue third parties in the LICENSOR Markets for infringements of the LICENSEE Patents and misappropriation of the LICENSEE Technology and unpatented LICENSEE Improvements, and LICENSEE shall, but at LICENSOR's expense for LICENSEE's direct associated expenses, fully and promptly cooperate and assist LICENSOR in connection with any such suit. LICENSEE may, if it so elects, join in any such suit as a plaintiff. LICENSOR shall promptly reimburse LICENSEE for said suit-associated direct expenses upon presentation of LICENSEE's itemized

statement therefor. All damages, awards or settlement proceeds in such suit shall be LICENSOR's. If LICENSOR, after notice from LICENSEE of an alleged infringement or misappropriation, shall within 90 days fail to institute suit, LICENSEE, in its own name (or, if required by law, in its and LICENSOR's name) and at its own expense, may sue therefore, and LICENSOR shall, but at LICENSEE's expense for LICENSOR's direct associated expenses, fully and promptly cooperate and assist LICENSEE in connection with any such suit. LICENSEE shall promptly reimburse LICENSOR for said suit-associated direct expenses upon presentation of LICENSOR's itemized statement therefor. All damages, awards or settlement proceeds in such suit shall be LICENSEE's.

2.12. LICENSEE Royalty Payment. None. License is granted without cost to LICENSEE.

ARTICLE 3
INDEMNIFICATION

3.1. Indemnification by LICENSEE. LICENSEE shall indemnify and hold LICENSOR and its successors and assigns harmless from any injury, loss, or damage of any kind or nature, or any other liability sought to be imposed on LICENSOR arising out of or in connection with or resulting from the marketing, sale or use of the LICENSEE Products, including any advertising or other promotional activities related thereto. LICENSOR shall be an added insured party to LICENSEE's product liability insurance, which shall have coverage limits of at least two million dollars ($2,000,000) per incident and which LICENSEE shall procure and have in place no later than the date on which LICENSEE first makes a delivery of any of the LICENSEE Products. Such policy of insurance shall provide that it may not be cancelled unless LICENSOR is provided at least thirty (30) days advance written notice.

3.2. Indemnification by LICENSOR. LICENSOR shall indemnify and hold LICENSEE and its successors and assigns harmless from any injury, loss, or damage of any kind or nature, or any other liability sought to be imposed on LICENSEE arising out of or in connection with or resulting from the marketing, sale or use of the LICENSOR Products, including any advertising or other promotional activities related thereto. At such time, if any, as LICENSOR shall sell LICENSOR Products, LICENSOR shall add LICENSEE as an added insured party to LICENSOR's product liability insurance, which shall have coverage limits of at least two million dollars ($2,000,000) per incident and which LICENSOR shall procure and have in place no later than the date on which LICENSOR first makes a delivery of any of the LICENSOR Products. Such policy of insurance shall provide that it may not be cancelled unless LICENSEE is provided at least thirty (30) days advance written notice.

ARTICLE 4
CONFIDENTIALITY

4.1. Restrictions on Use and Disclosure of LICENSOR Property by LICENSEE. LICENSEE shall use the LICENSOR Property in confidence and shall not

disclose same to its employees to whom access may be given in accordance with this Agreement until each such employee shall have previously agreed not to disclose such information. Restrictions on use and disclosure of any portion thereof shall terminate: (a) if that portion is, or becomes, generally known within the related trade or industry through no default of LICENSEE, or (b) upon the expiration of the obligation of LICENSEE under this Agreement to pay royalties to LICENSOR.

4.2. Restrictions on Use and Disclosure of LICENSEE Property by LICENSOR. LICENSOR shall use the LICENSEE Property in confidence and shall not disclose same to its employees to whom access may be given in accordance with this Agreement until each such employee shall have previously agreed not to disclose such information. Restrictions on use and disclosure of any portion thereof shall terminate if that portion is, or becomes, generally known within the related trade or industry through no default of LICENSOR.

4.3. Employees; Third Parties Etc. In order to faithfully perform their respective obligations under sections 4.1 and 4.2, the Parties shall limit access to the other Party's Property to only those of its officers, employees and agents who shall have a need to receive or have access to that portion, and then only for the purposes of the practice under the licenses conferred by this Agreement. Each Party will require any third party, to whom access may be authorized under this Agreement, to execute an appropriate confidentiality agreement.

4.4. Authorized Required Disclosures. Nothing in this Article 4 shall prevent a Party: (a) from complying (but only to the narrowest extent required by law and regulation and with due notice on any submissions to governmental agencies of the confidential or proprietary status of the information with a view toward restricting access to, and use or disclosure by, third parties) with reasonable requirements of governmental agencies to disclose information in order to receive legally required consents or permissions to manufacture or sell that Party's Products; or (b) from disclosing information under court order, but only after having made all reasonable efforts to secure the court's order to (i) limit production, use and disclosure of said information for the purposes of the case and to the narrowest class of disclosures practicable under the circumstances and (ii) hold all proceedings in camera with a sealed record.

ARTICLE 5
RESOLUTION OF DISPUTES

All claims, disputes and other matters in question arising out of, or relating to, this Agreement or the performance thereof shall be submitted to, and determined by, arbitration if good faith negotiations between the parties do not resolve such claim, dispute or other matter within 60 days. Such arbitration shall proceed in accordance with the Commercial Arbitration Rules of the American Arbitration Association then pertaining (the "Rules"), insofar as such Rules are not inconsistent with the provisions expressly set forth in this Agreement, unless the parties mutually agree otherwise, and pursuant to the following procedures:

(a) Notice of the demand for arbitration shall be filed in writing with the other Member and with the American Arbitration Association. Each Member shall appoint an arbitrator, and those party-appointed arbitrators shall appoint a third neutral arbitrator within 10 days. If the party-appointed arbitrators fail to appoint a third, neutral arbitrator within 10 days, such third, neutral arbitrator shall be appointed by the American Arbitration Association in accordance with the Rules. A determination by a majority of the panel shall be binding.

(b) Reasonable discovery shall be allowed in arbitration.

(c) All proceedings before the arbitrators shall be held in Minneapolis, Minnesota. The governing law shall be as specified in Section 8.1 below.

(d) The costs and fees of the arbitration, including attorneys' fees, shall be allocated by the arbitrators.

(e) The award rendered by the arbitrators shall be final and judgment may be entered in accordance with applicable law and in any court having jurisdiction thereof.

ARTICLE 6
NOTICES

6.1. Notices. All communications, demands, notices or objections required or permitted to be given or served under this Agreement shall be in writing and shall be deemed to have been duly given or made only if delivered in person, deposited in the United States mail, postage prepaid, for mailing by certified or registered mail, return receipt requested, or delivered by prepaid overnight courier service, addressed to the appropriate party as follows:

If to LICENSOR: Richard Disrud, COO
Aqua Innovations, Inc.
6101 Baker Rd., #206
Minnetonka, Minnesota 55435

If to LICENSEE: Jeffrey Brink, CEO
Oxygenator Water Technology, Inc.
6101 Baker Rd., #206
Minnetonka, Minnesota 55435

Either party may change its address by giving notice in writing, stating the new address, to the other Party as provided in the foregoing manner. Commencing on the tenth (10th) day after the giving of such notice, such newly designated address shall be such Party's address for the purpose of all communications, demands, notices or objections required or permitted to be given or served under this Agreement.

ARTICLE 7
MISCELLANEOUS

7.1. Governing Law; Court Proceedings. The validity, performance, and all matters relating to the interpretation and effect of this Agreement shall be governed by the internal law in effect in the State of Minnesota without regard to principles of law (such as "conflicts of law") that might make the law of some other jurisdiction applicable. Without limiting the terms set forth in Article 6 with respect to the resolution of disputes, each Party agrees to the exclusive and irrevocable jurisdiction of the federal and state courts of Minnesota for any claim, action or cause of action arising out of or in any way related to this Agreement which may be brought in a court of law and both parties agree that personal service from any such court may be effectively served upon a party at the respective addresses set forth in Section 7.1.

7.2. Exhibits. Exhibits, schedules and annexes referred to in this Agreement and attached hereto are incorporated herein in full by this reference as if each of such exhibits, schedules or annexes were set forth in the body of this Agreement and duly executed by the parties hereto.

7.3. Additional Documents and Acts. Each party agrees that it will use all reasonable efforts to take, or cause to be taken, all actions and to do, or cause to be done, all things necessary, proper or advisable, including, but not limited to, the execution of additional documents and instruments, to consummate, make effective and carry out the transactions contemplated by this Agreement.

7.4. Amendment, Modification or Waiver. No amendment, modification or waiver of any condition, provision or term of this Agreement shall be valid or of any effect unless made in writing, signed by the party or parties to be bound or its duly authorized representative and specifying with particularity the nature and extent of such amendment, modification or waiver. Any waiver by any party of a default of another party shall not affect or impair any right arising from any subsequent default.

7.5. Severable Provisions. Whenever possible, each provision of this Agreement will be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Agreement is held to be invalid, illegal or unenforceable under any applicable law or rule in any jurisdiction, such provision will be ineffective only to the extent of such invalidity, illegality, or unenforceability in such jurisdiction, without invalidating the remainder of this Agreement in such jurisdiction or any provision hereof in any other jurisdiction.

7.6. Entire Agreement. This Agreement contains the entire understanding of the parties hereto in respect of the transactions contemplated hereby and supersedes all prior agreements and understandings between the parties with respect to such subject matter.

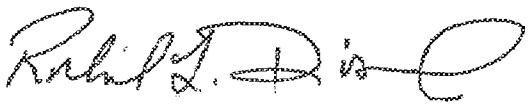
7.7. Captions, Headings, Titles or References to Gender. All captions, headings

or titles in the paragraphs or sections of this Agreement are inserted for convenience of reference only and shall not constitute a part of this Agreement or as a limitation of the scope of the particular paragraphs or sections to which they apply. Where appropriate, the masculine gender may be read as the feminine gender or the neuter gender, the feminine gender may be read as the masculine gender or the neuter gender and the neuter gender may be read as the masculine gender or the feminine gender.

7.8. Counterparts. This Agreement may be executed in two (2) or more counterparts, each of which shall be considered one and the same Agreement and shall become effective when one or more counterparts have been signed by each of the parties and delivered to the other parties.

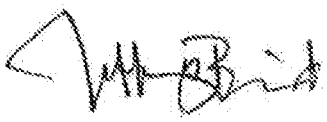
IN WITNESS WHEREOF, the parties have executed this Agreement on the date first written above.

AQUA INNOVATIONS, INC.



Dick Disrud its COO

OXYGENATOR WATER TECHNOLOGIES, INC.



Jeff Brink its CEO

EXHIBIT "A"

DESCRIPTION OF LICENSOR PATENTS AND PATENTS PENDING

United States Patent Number: US 6,689,262 B2
Date of Patent: February 10, 2004
Name: Microbubbles of Oxygen
Application Number: 10/372,017

An oxygen emitter which is an electrolytic cell. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The hydrogen forms bubbles at the cathode, which bubbles rise to the surface. The very small oxygen bubbles remain in suspension, forming a solution supersatured in oxygen.

United States Patent Number: US 7,396,441 B2
Publication Date: July 8, 2008
Name: Flow-Thru Oxygenator
Application Number: 10/732,326

An oxygen emitter which is an electrolytic cell. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The hydrogen forms bubbles at the cathode, which bubbles rise to the surface. The very small oxygen bubbles remain in suspension, forming a solution supersatured in oxygen. A flow-through model for oxygenating flowing water. The use of supersaturated water for enhancing the growth of plants. Method of applying supersaturated water to plants manually, by drip irrigation or in hydroponic culture. The treatment of waste water by raising the dissolved oxygen with the use of oxygen emitter.

Bibliographic Data

Application Number:	12/023,431	Customer Number:	
Filing or 371 (c) Date:	01-31-2008	Status:	Patented Case
Application Type:	Utility	Status Date:	02-10-2010
Examiner Name:	ALLEN, CAMERON J	Location:	ELECTRONIC
Group Art Unit:	1797	Location Date:	
Confirmation Number:	7381	Earliest Publication No:	US 2008-0179259 A1
Attorney Docket Number:	4056.02US03	Earliest Publication Date:	07-31-2008
Class / Subclass:	210/748	Patent Number:	7,670,495
First Named Inventor:	James Andrew Senkiw , Minneapolis, MN (US)	Issue Date of Patent:	03-02-2010

Title of Invention: FLOW-THROUGH OXYGENATOR

If you need help:

- *Call the Patent Electronic Business Center at (866) 217-9197 (toll free) or e-mail EBC@uspto.gov for specific questions about Patent Application Information Retrieval (PAIR).*
- *Send general questions about USPTO programs to the USPTO Contact Center (UCC) .*
- *If you experience technical difficulties or problems with this application, please report them via e-mail to Electronic Business Support or call 1 800-786-9199.*

THIS PATENT ISSUED 3/2/2010. IN DISCUSSION WITH PAUL HANN, IT GIVES US BROAD COVERAGE.

United States Patent **7,670,495**
Senkiw **March 2, 2010**

Flow-through oxygenator

Abstract

An oxygen emitter which is an electrolytic cell is disclosed. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The very small oxygen bubbles remain in suspension, forming a solution supersaturated in oxygen. A flow-through model for oxygenating flowing water is disclosed. The use of supersaturated water for enhancing the growth of plants is disclosed. Methods for applying supersaturated water to plants manually, by drip irrigation or in hydroponic culture are described. The treatment of waste water by raising the dissolved oxygen with the use of an oxygen emitter is disclosed.

Inventors: **Senkiw; James Andrew** (Minneapolis, MN)
Assignee: **Oxygenator Water Technologies, Inc.** (Minnetonka, MN)
Appl. No.: **12/023,431**
Filed: **January 31, 2008**

Related U.S. Patent Documents

Application Number	Filing Date	Patent Number	Issue Date
10732326	Dec., 2003	7396441	
10372017	Feb., 2004	6689262	
60358534	Feb., 2002		

Current U.S. Class: 204/232; 204/245; 205/628; 210/243; 210/600
Current International Class: C02F 1/48 (20060101); C02F 1/00 (20060101); C25B 1/02 (20060101); C25B 1/04 (20060101)
Field of Search: 210/748,600,243 204/278,242,243,275.1,232,286.1,554,660 205/633-638

References Cited [Referenced By]

U.S. Patent Documents

4071447	January 1978	Ramirez
4225401	September 1980	Divisek et al.
4252856	February 1981	Sara
4257352	March 1981	Habegger
4587001	May 1986	Cairns et al.
5015354	May 1991	Nishiki et al.
5148772	September 1992	Kirschbaum
5534143	July 1996	Portier et al.
5982609	November 1999	Evans
6171469	January 2001	Hough et al.
6315886	November 2001	Zappi
6328875	December 2001	Zappi et al.
6394429	May 2002	Ganan-Calvo
6524475	February 2003	Herrington et al.
6689262	February 2004	Senkiw
7396441	July 2008	Senkiw
2002/0074237	June 2002	Takesako et al.
2003/0164306	September 2003	Senkiw
2004/0118701	June 2004	Senkiw
2006/0150491	July 2006	Senkiw
2008/0202995	August 2008	Senkiw

Foreign Patent Documents

0 723 936	Jul., 1996	EP
1 522 188	Aug., 1978	GB
WO 99/39561	Aug., 1999	WO
WO 01/89997	Nov., 2001	WO
WO 03/072507	Sep., 2003	WO

Other References

Mohyuddin Mirza et al., "Effect of Oxygenated Water on the Growth & Biomass Development of Seedless Cucumbers and Tomato Seedlings under Greenhouse Conditions," Seair Diffusion Systems, 2003, 5 pages, www.seair.ca. cited by other.

Primary Examiner: Griffin; Walter D
Assistant Examiner: Allen; Cameron J
Attorney, Agent or Firm: Patterson, Thuente, Skaar & Christensen, P.A.

Parent Case Text

RELATED APPLICATIONS

This application is a division of application Ser. No. 10/732,326 filed Dec. 10, 2003, which in turn is a continuation-in-part of application Ser. No. 10/372,017, filed Feb. 21, 2003, now U.S. Pat. No. 6,689,262, which claims the benefit of U.S. Provisional Application No. 60/358,534, filed Feb. 22, 2002, each of which is hereby fully incorporated herein by reference.

Claims

The invention claimed is:

1. A method for treating waste water comprising; providing a flow-through oxygenator comprising an emitter for electrolytic generation of microbubbles of oxygen comprising an anode separated at a critical distance from a cathode and a power source all in electrical communication with each other, placing the emitter within a conduit; and passing waste water through the conduit.

2. An emitter for electrolytic generation of microbubbles of oxygen in an aqueous medium comprising: an anode separated at a critical distance from a cathode, a nonconductive spacer maintaining the separation of the anode and cathode, the nonconductive spacer having a spacer thickness between 0.005 to 0.050 inches such that the critical distance is less than 0.060 inches and a power source all in electrical communication with each other, wherein the critical distance results in the formation of oxygen bubbles having a bubble diameter less than 0.0006 inches, said oxygen bubbles being incapable of breading the surface tension of the aqueous medium such that said aqueous medium is supersaturated with oxygen.

3. The emitter of claim 2, wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide.

4. The emitter of claim 2, wherein the anode is platinum and iridium oxide on a support.

5. The emitter of claim 2, wherein the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

6. The emitter of claim 2, wherein the critical distance is 0.005 to 0.060 inches.

7. The emitter of claim 2, comprising a plurality of anodes separated at the critical distance from a plurality of cathodes.

8. A method for oxygenating a non-native habitat for temporarily keeping aquatic animals, comprising: inserting the emitter of claim 2 into the aqueous medium, the non-native habitat comprising an aquarium, a bait bucket or a live well.

9. A method for lowering the biologic oxygen demand of polluted water comprising: passing the polluted water through a vessel containing the emitter of claim 2.

10. A supersaturated aqueous product formed with the emitter of claim 2, the supersaturated aqueous product having an approximately neutral pH.

11. The emitter of claim 2, further comprising a timer control.

12. The emitter of claim 2, wherein the anode and cathode are arranged such that the emitter assumes a funnel or pyramidal shaped emitter.

Description

FIELD OF THE INVENTION

This invention relates to the electrolytic generation of microbubbles of oxygen for increasing the oxygen content of flowing water. This invention also relates to the use of superoxygenated water to enhance the growth and yield of plants. The flow-through model is useful for oxygenating water for hydroponic plant culture, drip irrigation and waste water treatment.

BACKGROUND OF THE INVENTION

Many benefits may be obtained through raising the oxygen content of aqueous media. Efforts have been made to achieve higher saturated or supersaturated oxygen levels for applications such as the improvement of water quality in ponds, lakes, marshes and reservoirs, the detoxification of contaminated water, culture of fish, shrimp and other aquatic animals, biological culture and hydroponic culture. For example, fish held in a limited environment such as an aquarium, a bait bucket or a live hold tank may quickly use up the dissolved oxygen in the course of normal respiration and are then subject to hypoxic stress, which can lead to death. A similar effect is seen in cell cultures, where the respiring cells would benefit from higher oxygen content of the medium. Organic pollutants from agricultural, municipal and industrial facilities spread through the ground and surface water and adversely affect life forms. Many pollutants are toxic, carcinogenic or mutagenic. Decomposition of these pollutants is facilitated by oxygen, both by direct chemical detoxifying reactions or by stimulating the growth of detoxifying microflora. Contaminated water is described as having an increased biological oxygen demand (BOD) and water treatment is aimed at decreasing the BOD so as to make more oxygen available for fish and other life forms.

The most common method of increasing the oxygen content of a medium is by sparging with air or oxygen. While this is a simple method, the resulting large bubbles produced simply break the surface and are discharged into the atmosphere. Attempts have been made to reduce the size of the bubbles in order to facilitate oxygen transfer by increasing the total surface area of the oxygen bubbles. U.S. Pat. No. 5,534,143 discloses a microbubble generator that achieves a bubble size of about 0.10 millimeters to about 3 millimeters in diameter. U.S. Pat. No. 6,394,429 ("the '429 patent") discloses a device for producing microbubbles, ranging in size from 0.1 to 100 microns in diameter, by forcing air into the fluid at high pressure through a small orifice.

When the object of generating bubbles is to oxygenate the water, either air, with an oxygen content of about 21%, or pure oxygen may be used. The production of oxygen and hydrogen by the electrolysis of water is well known. A current is applied across an anode and a cathode which are immersed in an aqueous medium. The current may be a direct current from a battery or an AC/DC converter from a line. Hydrogen gas is produced at the cathode and oxygen gas is produced at the anode. The reactions are:

TABLE-US-00001 AT THE CATHODE: 4H.sub.2O + 4e.sup.- .fwdarw. 4OH.sup.- + 2H.sub.2 AT THE ANODE: 2H.sub.2O .fwdarw. O.sub.2 + 4H.sup.+ + 4e.sup.- NET REACTION: 6H.sub.2O .fwdarw. 4OH.sup.- + 4H.sup.+ ++ 2H.sub.2 + O.sub.2

286 kilojoules of energy is required to generate one mole of oxygen.

The gasses form bubbles which rise to the surface of the fluid and may be collected. Either the oxygen or the hydrogen may be collected for various uses. The "electrolytic water" surrounding the anode becomes acidic while the electrolytic water surrounding the cathode becomes basic. Therefore, the electrodes tend to foul or pit and have a limited life in these corrosive environments.

Many cathodes and anodes are commercially available. U.S. Pat. No. 5,982,609 discloses cathodes comprising a metal or metallic oxide of at least one metal selected from the group consisting of ruthenium, iridium, nickel, iron, rhodium, rhenium, cobalt, tungsten, manganese, tantalum, molybdenum, lead, titanium, platinum, palladium and osmium. Anodes are formed from the same metallic oxides or metals as cathodes. Electrodes may also be formed from alloys of the above metals or metals and oxides co-deposited on a substrate. The cathode and anodes may be formed on any convenient support in any desired shape or size. It is possible to use the same materials or different materials for both electrodes. The choice is determined according to the uses. Platinum and iron alloys ("stainless steel") are often preferred materials due to their inherent resistance to the corrosive electrolytic water. An especially preferred anode disclosed in U.S. Pat. No. 4,252,856 comprises vacuum deposited iridium oxide.

Holding vessels for live animals generally have a high population of animals which use up the available oxygen rapidly. Pumps to supply oxygen have high power requirements and the noise and bubbling may further stress the animals. The available electrolytic generators likewise have high power requirements and additionally run at high voltages and produce acidic and basic water which are detrimental to live animals. Many of the uses of oxygenators, such as keeping bait or caught fish alive, would benefit from portable devices that did not require a source of high power. The need remains for quiet, portable, low voltage means to oxygenate water.

It has also been known that plant roots are healthier when oxygenated water is applied. It is thought that oxygen inhibits the growth of deleterious fungi. The water sparged with air as in the '429 patent was shown to increase the biomass of hydroponically grown cucumbers and tomatoes by about 15%.

The need remains for oxygenator models suitable to be placed in-line in water distribution devices so as to be applied to field as well as hydroponic culture.

SUMMARY OF THE INVENTION

This invention provides an oxygen emitter which is an electrolytic cell which generates very small microbubbles and nanobubbles of oxygen in an aqueous medium, which bubbles are too small to break the surface tension of the medium, resulting in a medium supersaturated with oxygen.

The electrodes may be a metal or oxide of at least one metal selected from the group consisting of ruthenium, iridium, nickel, iron, rhodium, rhenium, cobalt, tungsten, manganese, tantalum, molybdenum, lead, titanium, platinum, palladium and osmium or oxides thereof. The electrodes may be formed into open grids or may be closed surfaces. The most preferred cathode is a stainless steel mesh. The most preferred mesh is a 1/16 inch grid. The most preferred anode is platinum and iridium oxide on a support. A preferred support is titanium.

In order to form microbubbles and nanobubbles, the anode and cathode are separated by a critical distance. The critical distance ranges from 0.005 inches to 0.140 inches. The preferred critical distance is from 0.045 to 0.060 inches.

Models of different size are provided to be applicable to various volumes of aqueous medium to be oxygenated. The public is directed to choose the applicable model based on volume and power requirements of projected use. Those models with low voltage requirements are especially suited to oxygenating water in which animals are to be held.

Controls are provided to regulate the current and timing of electrolysis.

A flow-through model is provided which may be connected in-line to a watering hose or to a hydroponic circulating system. The flow-through model can be formed into a tube with triangular cross-section. In this model, the anode is placed toward the outside of the tube and the cathode is placed on the inside, contacting the water flow. Alternatively, the anodes and cathodes may be in plates parallel to the long axis of the tube, or may be plates in a wafer stack. Alternately, the electrodes may be placed in a side tube ("T" model) out of the direct flow of water. Protocols are provided to produce superoxygenated water at the desired flow rate and at the desired power usage. Controls are inserted to activate electrolysis when water is flowing and deactivate electrolysis at rest.

This invention includes a method to promote growth and increase yield of plants by application of superoxygenated water. The water treated with the emitter of this invention is one example of superoxygenated water. Plants may be grown in hydroponic culture or in soil. The use of the flow-through model for drip irrigation of crops and waste water treatment is disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is the O.sub.2 emitter of the invention.

FIG. 2 is an assembled device.

FIG. 3 is a diagram of the electronic controls of the O.sub.2 emitter.

FIG. 4 shows a funnel or pyramid variation of the O.sub.2 emitter.

FIG. 5 shows a multilayer sandwich O.sub.2 emitter.

FIG. 6 shows the yield of tomato plants watered with superoxygenated water.

FIG. 7 shows an oxygenation chamber suitable for flow-through applications. FIG. 7A is a cross section showing arrangement of three plate electrodes. FIG. 7B is a longitudinal section showing the points of connection to the power source.

FIG. 8 is a graph showing the oxygenation of waste water.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

For the purpose of describing the present invention, the following terms have these meanings:

"Critical distance" means the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.

"Critical distance" means the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.

"O.sub.2 emitter" means a cell comprised of at least one anode and at least one cathode separated by the critical distance.

"Metal" means a metal or an alloy of one or more metals.

"Microbubble" means a bubble with a diameter less than 50 microns.

"Nanobubble" means a bubble with a diameter less than that necessary to break the surface tension of water. Nanobubbles remain suspended in the water, giving the water an opalescent or milky appearance.

"Supersaturated" means oxygen at a higher concentration than normal calculated oxygen solubility at a particular temperature and pressure.

"Superoxygenated water" means water with an oxygen content at least 120% of that calculated to be saturated at a temperature.

"Water" means any aqueous medium with resistance less than one ohm per square centimeter; that is, a medium that can support the electrolysis of water. In general, the lower limit of resistance for a medium that can support electrolysis is water containing more than 2000 ppm total dissolved solids.

The present invention produces microbubbles and nanobubbles of oxygen via the electrolysis of water. As molecular oxygen radical (atomic weight 8) is produced, it reacts to form molecular oxygen, O.sub.2. In the special dimensions of the invention, as explained in more detail in the following examples, O.sub.2 forms bubbles which are too small to break the surface tension of the fluid. These bubbles remain suspended indefinitely in the fluid and, when allowed to build up, make the fluid opalescent or milky. Only after several hours do the bubbles begin to coalesce on the sides of the container and the water clears. During that time, the water is supersaturated with oxygen. In contrast, the H.sub.2 formed readily coalesces into larger bubbles which are discharged into the atmosphere, as can be seen by bubble formation at the cathode.

The first objective of this invention was to make an oxygen emitter with low power demands, low voltage and low current for use with live animals. For that reason, a small button emitter was devised. The anode and cathode were set at varying distances. It was found that electrolysis took place at very short distances before arcing of the current occurred. Surprisingly, at slightly larger distances, the water became milky and no bubbles formed at the anode, while hydrogen continued to be bubbled off the cathode. At distance of 0.140 inches between the anode and cathode, it was observed that the oxygen formed bubbles at the anode. Therefore, the critical distance for microbubble and nanobubble formation was determined to be between 0.005 inches and 0.140 inches.

EXAMPLE 1

Oxygen Emitter

As shown in FIG. 1, the oxygen evolving anode 1 selected as the most efficient is an iridium oxide coated single sided sheet of platinum on a support of titanium (Eltech, Fairport Harbor, Ohio). The cathode 2 is a (fraction (1/16)} inch mesh (size 8 mesh) marine stainless steel screen. The anode and cathode are separated by a non-conducting spacer 3 containing a gap 4 for the passage of gas and mixing of anodic and cathodic water and connected to a power source through a connection point 5. FIG. 2

shows a plan view of the assembled device. The O.sub.2 emitter 6 with the anode connecting wire 7 and the cathode connecting wire 8 is contained in an enclosure 9, connected to the battery compartment 10. The spacer thickness is critical as it sets the critical distance. It must be of sufficient thickness to prevent arcing of the current, but thin enough to separate the electrodes by no more than 0.140 inches. Above that thickness, the power needs are higher and the oxygen bubbles formed at higher voltage will coalesce and escape the fluid. Preferably, the spacer is from 0.005 to 0.075 inches thick. At the lower limits, the emitter tends to foul more quickly. Most preferably, the spacer is about 0.050 inches thick. The spacer may be any nonconductive material such as nylon, fiberglass, Teflon.RTM., polymer or other plastic. Because of the criticality of the space distance, it is preferable to have a non-compressible spacer. It was found that Buna, with a durometer measure of 60 was not acceptable due to decomposition. Viton, a common fluoroelastomer, has a durometer measure of 90 and was found to hold its shape well.

In operation, a small device with an O.sub.2 emitter 1.485 inches in diameter was driven by 4AA batteries. The critical distance was held at 0.050 inches with a Viton spacer. Five gallons of water became saturated in seven minutes. This size is suitable for raising oxygen levels in an aquarium or bait bucket.

It is convenient to attach a control circuit which comprises a timer that is thermostatically controlled by a temperature sensor which determines the off time for the cathode. When the temperature of the solution changes, the resistance of the thermistor changes, which causes an off time of a certain duration. In cool water, the duration is longer so in a given volume, the emitter generates less oxygen. When the water is warmer and therefore hold less oxygen, the duration of off time is shorter. Thus the device is self-controlled to use power most economically. FIG. 3 shows a block diagram of a timer control with anode 1, cathode 2, thermistor temperature sensor 3, timer control circuit 4 and wire from a direct current power source 5.

EXAMPLE 2

Measurement of O.sub.2 Bubbles

Attempts were made to measure the diameter of the O.sub.2 bubbles emitted by the device of Example 1. In the case of particles other than gasses, measurements can easily be made by scanning electron microscopy, but gasses do not survive electron microscopy. Large bubble may be measured by pore exclusion, for example, which is also not feasible when measuring a gas bubble. A black and white digital, high contrast, backlit photograph of treated water with a millimeter scale reference was shot of water produced by the emitter of Example 1. About 125 bubbles were seen in the area selected for measurement. Seven bubbles ranging from the smallest clearly seen to the largest were measured. The area was enlarged, giving a scale multiplier of 0.029412.

Recorded bubble diameters at scale were 0.16, 0.22, 0.35, 0.51, 0.76, 0.88 and 1.09 millimeters. The last three were considered outliers by reverse analysis of variance and were assumed to be hydrogen bubbles. When multiplied by the scale multiplier, the assumed O.sub.2 bubbles were found to range from 4.7 to 15 microns in diameter. This test was limited by the resolution of the camera and smaller bubbles in the nanometer range could not be resolved. It is known that white light cannot resolve features in the nanometer size range, so monochromatic laser light may give resolution sensitive enough to measure smaller bubbles. Efforts continue to increase the sensitivity of measurement so that sub-micron diameter bubbles can be measured.

EXAMPLE 3

Other Models of Oxygen Emitter

Depending on the volume of fluid to be oxygenated, the oxygen emitter of this invention may be shaped as a circle, rectangle, cone or other model. One or more may be set in a substrate that may be metal, glass, plastic or other material. The substrate is not critical as long as the current is isolated to the electrodes by the nonconductor spacer material of a thickness from 0.005 to 0.075 inches, preferably 0.050 inches. It has been noticed that the flow of water seems to be at the periphery of the emitter, while the evolved visible bubbles (H.sub.2) arise at the center of the emitter. Therefore, a funnel or pyramidal shaped emitter was constructed to treat larger volumes of fluid. FIG. 4 is a cross sectional diagram of such an emitter. The anode 1 is formed as an open grid separated from a marine grade stainless steel screen cathode 2 by the critical distance by spacer 3 around the periphery of the emitter and at the apex. This flow-through embodiment is suitable for treating large volumes of water rapidly.

The size may be varied as required. A round emitter for oxygenating a bait bucket may be about 2 inches in diameter, while a 3-inch diameter emitter is adequate for oxygenating a 10 to 40 gallon tank. The live well of a fishing boat will generally hold 40 to 80 gallons of water and require a 4-inch diameter emitter. It is within the scope of this invention to construct larger emitters or to use several in a series to oxygenate larger volumes. It is also within the scope of this invention to vary the model to provide for low voltage and amperage in cases where the need for oxygen is moderate and long lasting or conversely, to supersaturate water very quickly at higher voltage and amperage. In the special dimensions of the present invention, it has been found that a 6 volt battery supplying a current as low as 40 milliamperes is sufficient to generate oxygen. Such a model is especially useful with live plants or animals, while it is more convenient for industrial use to use a higher voltage and current. Table I shows a number of models suitable to various uses.

TABLE-US-00002 TABLE I Emitter Model Gallons Volts Amps Max. Ave Watts Bait keeper 5 6 0.090 0.060 0.36 Livewell 32 12 0.180 0.120 1.44 OEM 2 inch 10 12 0.210 0.120 1.44 Bait store 70 12 0.180 0.180 2.16 Double cycle 2 12 0.180 0.180 2.16 OEM 3 inch 50 12 0.500 0.265 3.48 OEM 4 inch 80 12 0.980 0.410 4.92 Water pail 2 24 1.200 1.200 28.80 Plate 250 12 5.000 2.500 30.00

EXAMPLE 4

Multilayer Sandwich O.sub.2 Emitter

An O.sub.2 emitter was made in a multilayer sandwich embodiment. (FIG. 5) An iridium oxide coated platinum anode 1 was formed into a grid to allow good water flow and sandwiched between two stainless steel screen cathodes 2. Spacing was held at the critical distance by nylon spacers 3. The embodiment illustrated is held in a cassette 4 which is secured by nylon bolt 5 with a nylon washer 6. The dimensions selected were:

TABLE-US-00003 cathode screen 0.045 inches thick nylon spacer 0.053 inches thick anode grid 0.035 inches thick nylon spacer 0.053 inches thick cathode screen 0.045 inches thick,

for an overall emitter thickness of 0.231 inches thick inches.

If a more powerful emitter is desired, it is within the scope of this invention to repeat the sequence of stacking. For example, an embodiment may easily be constructed with this sequence: cathode, spacer, anode, spacer, cathode, spacer, anode, spacer, cathode, spacer, anode, spacer, cathode. The number of layers in the sandwich is limited only by the power requirements acceptable for an application.

EXAMPLE 5

Effect of Superoxygenated Water on the Growth of Plants

It is known that oxygen is important for the growth of plants. Although plants evolve oxygen during photosynthesis, they also have a requirement for oxygen for respiration. Oxygen is evolved in the leaves of the plants, while often the roots are in a hypoxic environment without enough oxygen to support optimum respiration, which can be reflected in less than optimum growth and nutrient utilization. Hydroponically grown plants are particularly susceptible to oxygen deficit in the root system. U.S. Pat. No. 5,887,383 describes a liquid supply pump unit for hydroponic cultures which attain oxygen enrichment by sparging with air. Such a method has high energy requirements and is noisy. Furthermore, while suitable for self-contained hydroponic culture, the apparatus is not usable for field irrigation. In a report available on the web, it was shown that hydroponically grown cucumbers and tomatoes supplied with water oxygenated with a device similar to that described in the '429 patent had increased biomass of about 12% and 17% respectively. It should be noted that when sparged with air, the water may become saturated with oxygen, but it is unlikely that the water is superoxygenated.

A. Superoxygenated Water in Hydroponic Culture.

Two small hydroponic systems were set up to grow two tomato plants. Circulation protocols were identical except that the 2 1/2 gallon water reservoir for the Control plant was eroated with and aquarium bubbler and that for the Test plant was oxygenated with a five-inch strip emitter for two minutes prior to pumping. The cycle was set at four minutes of pumping, followed by four minutes of rest. The control water had an oxygen content of about 97% to 103% saturation, that is, it was saturated with oxygen. The test water had an oxygen content of about 153% to 165% saturation, that is, it was supersaturated. The test plant was at least four times the volume of the control plant and began to show what looked like fertilizer burn. At that point the fertilizer for the Test plant was reduced by half. Since the plants were not exposed to natural light but to continuous artificial light in an indoor environment without the natural means of fertilization (wind and/or insects), the experiment was discontinued after three months. At that time, the Test plant but not the Control plant had blossomed.

B. Superoxygenated Water in Field Culture.

A pilot study was designed to ascertain that plants outside the hydroponic culture facility would benefit from the application of oxygen. It was decided to use water treated with the emitter of Example 1 as the oxygen carrier. Since water so treated is supersaturated, it is an excellent carrier of oxygen.

Tomato seeds (Burpee "Big Boy") were planted in one-inch diameter peat and dirt plugs encased in cheese cloth and placed in a tray in a southwest window. Controls were watered once a day with tap water ("Control") or oxygenated water ("Test"). Both Controls and Test sprouted at one week. After five weeks, the Test plants were an average of 11 inches tall while the Controls were an average of nine inches tall. At this time, May 10, when the threat of frost in Minnesota was minimal, the plants were transplanted to 13 inch diameter pots with drainage holes. Four inches of top soil was added to each pot, topped off with four inches of Scott's Potting Soil. The pots were placed outside in a sunny area with at least eight hours a day of full sun. The plants were watered as needed with either plain tap water (Control) or oxygenated water (Test). The oxygenated water was produced by use of the emitter of Example 1 run for one-half hour in a five-gallon container of water. Previous experiments showed that water thus treated had an oxygen content from 160% to 260% saturation. The Test plants flowered on June 4, while the Controls did not flower until June 18. For both groups, every plant in the group first had flowers on the same day. All plants were fertilized on July 2 and a soaker hose provided because the plants were now so big that watering by hand was difficult. The soaker hose was run for one half to one hour each morning, depending on the weather, to a point at which the soil was saturated with water. One

half hour after the soaker hose was turned off, about 750 ml of superoxygenated water was applied to each of the Test plants.

The Test plants were bushier than the Controls although the heights were similar. At this time, there were eight Control plants and seven Test plants because one of the Test plants broke in a storm. On July 2, the control plants averaged about 17 primary branches from the vine stem, while the control plants averaged about 13 primary branches from the vine stem. As the tomatoes matured, each was weighed on a kitchen scale at harvest. The yield history is shown in Table II.

TABLE-US-00004 TABLE II Control, grams Test, grams tomatoes from tomatoes from eight plants/ seven plants/ Week of: cumulative total cumulative total July 27 240 400 August 3 180 420 2910 3310 August 10 905 1325 1830 5140 August 17 410 1735 2590 7730 August 24 3300 5035 2470 10200 August 31 4150 9175 1580 11780 September 15 not weighed 3710 15490 Final Harvest 6435 15620 8895 24385 September 24

The total yield for the eight Control plants was 15620 grams or 1952 grams of tomatoes per plant.

The total yield for the seven Test plants was 24385 grams or 3484 grams of tomatoes per plant, an increase in yield of about 79% over the Control plants.

FIG. 6 shows the cumulative total as plotted against time. Not only did the Test plants blossom and bear fruit earlier, but that the Control plants never caught up to the test plants in the short Minnesota growing season. It should be noted that the experiment was terminated because of predicted frost. All fruits, both green and red, were harvested and weighed at that point.

EXAMPLE 6

Flow-Through Emitter for Agricultural Use

In order to apply the findings of example 5 to agricultural uses, an emitter than can oxygenate running water efficiently was developed. In FIG. 7(A), the oxygenation chamber is comprised of three anodes 1 and cathodes 2, of appropriate size to fit inside a tube or hose and separated by the critical distance are placed within a tube or hose 3 at 120.degree. angles to each other. The anodes and cathodes are positioned with stabilizing hardware 4. The stabilizing hardware, which can be any configuration such as a screw, rod or washer, is preferably formed from stainless steel. FIG. 7(B) shows a plan view of the oxygenation chamber with stabilizing hardware 4 serving as a connector to the power source and stabilizing hardware 5 serving as a connector to the power source. The active area is shown at 6.

This invention is not limited to the design selected for this embodiment. Those skilled in the art can readily fabricate any of the emitters shown in FIG. 4 or 5, or can design other embodiments that will oxygenate flowing water. One useful embodiment is the "T" model, wherein the emitter unit is set in a side arm. The emitted bubbles are swept into the water flow. The unit is detachable for easy servicing. Table III shows several models of flow through emitters. The voltage and flowrates were held constant and the current varied. The Dissolved oxygen (DO) from the source was 7.1 mg/liter. The starting temperature was 12.2.degree. C. but the flowing water cooled slightly to 11 or 11.5.degree. C. Without undue experimentation, anyone may easily select the embodiment that best suits desired characteristics from Table III or designed with the teachings of Table III.

TABLE-US-00005 TABLE III ACTIVE DO OF* ELECTRODE CURRENT, FLOW RATE SAMPLE AT MODEL AREA, SQ.IN. VOLTAGE AMPS. GAL/MINUTE ONE MINUTE 2-Inch "T" 2 28.3 0.72 12 N/A 3-inch "T" 3 28.3 1.75 12 N/A 2-plate Tube 20 28.3 9.1 12 8.4 3-Plate tube 30 28.3 12.8 12 9.6

*As the apparatus runs longer, the flowing water becomes milky, indicating supersaturation. The one-minute time point shows the rapid increase in oxygenation.

The following plants will be tested for response to superoxygenated water: grape vines, lettuce, and radishes in three different climate zones. The operators for these facilities will be supplied with units for drip irrigation. Drip irrigation is a technique wherein water is pumped through a pipe or hose with perforations at the site of each plant to be irrigated. The conduit may be underground or above ground. Since the water is applied directly to the plant rather than wetting the entire field, this technique is especially useful in arid climates or for plants requiring high fertilizer applications.

The superoxygenated water will be applied by drip irrigation per the usual protocol for the respective plants. Growth and yield will be compared to the same plants given only the usual irrigation water. Pest control and fertilization will be the same between test and control plants, except that the operators of the experiments will be cautioned to be aware of the possibility of fertilizer burn in the test plants and to adjust their protocols accordingly.

It is expected that the superoxygenated plants with drip irrigation will show more improved performance with more continuous application of oxygen than did the tomato plants of Example 5, which were given superoxygenated water only once a day.

EXAMPLE 7

Treatment of Waste Water

Waste water, with a high organic content, has a high BOD, due to the bacterial flora. It is desirable to raise the oxygen content of the waste water in order to cause the flora to flocculate. However, it is very difficult to effectively oxygenate such water. Using a 4 inch OEM (see Table I) with a 12 volt battery, four liters of waste water in a five gallon pail were oxygenated. As shown in FIG. 8, the dissolved oxygen went from 0.5 mg/l to 10.8 mg/l in nine minutes.

Those skilled in the art will readily comprehend that variations, modifications and additions may in the embodiments described herein may be made. Therefore, such variations, modifications and additions are within the scope of the appended claims.

* * * * *

AGREEMENT OF STRICT FORECLOSURE

THIS AGREEMENT OF STRICT FORECLOSURE (the "Agreement") is made, entered into and effective as of October 4, 2012 (the "Effective Date"), by and between AQUA INNOVATIONS INCORPORATED ("Debtor"), a Minnesota corporation, and ROY H. LECY ("Secured Party"), who holds a certain security interest in the assets of Debtor as set forth below as security under a certain Promissory Note dated December 1, 2006, executed by Debtor in favor of Secured Party in the principal amount of Two Hundred Eighteen Thousand Eight Hundred Twenty-Seven and 29/100 Dollars ($218,827.49) (the "Note"). Either Debtor or Secured Party may be individually referred to herein as a "party" or collectively as the "parties."

RECITALS

WHEREAS, Secured Party is a shareholder of Debtor who holds nine hundred twenty-eight thousand three hundred thirty-four (928,334) shares of Debtor's common stock and twenty-six thousand six hundred sixty-seven (26,667) shares of Debtor's Preferred Series A stock; and

WHEREAS, Secured Party loaned Debtor various amounts of money over the course of several years, as documented in the Note; and

WHEREAS, Debtor is in default of its obligations pursuant to the Note; and

WHEREAS, as of December 31, 2011, the sum of Two Hundred Seven Thousand Ninety-Eight and no/100 Dollars ($207,098.00) remains due and owing Secured Party from Debtor (the "Outstanding Debt"); and

WHEREAS, the Note provides Secured Party a security interest in all of Debtor's "patents and physical assets"; and

WHEREAS, Secured Party perfected his security interest via the filing of a Uniform Commercial Code Financing Statement with the Minnesota Secretary of State on or about February 10, 2012, Filing Number 201227190568; and

WHEREAS, Secured Party is currently the only secured creditor of Debtor; and

WHEREAS, Debtor is no longer a going business concern; and

WHEREAS, Debtor has no viable assets other than its rights as Licensee under that certain License Agreement dated July 30, 2008 (the "License Agreement"), a copy of which is attached hereto as Exhibit A, entered into by and between Debtor and Oxygenator Water Technologies, Inc. ("OWT"), a Minnesota corporation, pursuant to which Debtor holds certain perpetual, exclusive and royalty free licenses as further described in the License Agreement, any property of Debtor as set forth in the License Agreement, including but not limited to any Licensee Documents, Licensee Improvements, Licensee Patents, Licensee Products, Licensee Property or Licensee Technology, all as defined in the License Agreement and certain shares of

OWT's common stock held by Debtor (the "OWT Stock" or collectively with the License Agreement and the other property of Debtor set forth herein, the "Collateral"); and

WHEREAS, Secured Party, as Debtor's sole secured creditor, is entitled to foreclose on the Collateral securing the Note; and

WHEREAS, Secured Party has agreed and Debtor has consented to Secured Party's acceptance of the Collateral in full satisfaction of Debtor's obligations under the Note in accordance with Sections 9-620 through 9-622 of the Uniform Commercial Code (the "UCC"), as adopted in the State of Minnesota as Minnesota Statutes Sections 336.9-620 through 336.9-622.

AGREEMENTS

NOW, THEREFORE, in consideration of the foregoing, Debtor and Secured Party hereto agree as follows:

1. Recitals. Debtor hereby acknowledges that the recitals set forth above are true and correct and such recitals are hereby made a part of this Agreement.

2. Conveyance of Collateral; Satisfaction of Outstanding Debt. Pursuant to Minnesota Statutes Sections 336.9-620 through 336.9-622, Debtor assigns all right, title and interest in and to the Collateral to Secured Party, agrees to immediately surrender the Collateral to Secured Party and Secured Party shall retain the Collateral in full satisfaction of the Outstanding Debt. Debtor shall deliver the Stock Powers Certificate (Assignment Separate from Certificate) for the OWT Stock attached hereto as Exhibit B to Secured Party contemporaneous with Debtor's execution of this Agreement. Secured Party does not assume, and nothing herein shall be construed to obligate Secured Party to pay, any leases, liabilities or obligations of Debtor.

3. Waiver. Pursuant to Section 9-624 of the UCC, Minnesota Statutes Section 336.9-624, Debtor hereby waives and renounces all of its rights to notification under Section 9-611 of the UCC, Minnesota Statutes Section 336.9-611, or any other state in which any Collateral may be located as to the sale or other disposition by Secured Party of the Collateral and all rights under Sections 9-620 and 9-623 of the UCC, Minnesota Statutes Sections 336.9-620 and 336.9-623, regarding acceptance of collateral as discharge of the obligations of Debtor to Secured Party, mandatory disposition of the Collateral and the waiver of Debtor's rights to redeem collateral, respectively. Debtor further knowingly and intelligently waives any rights it may have to notice and a hearing before a court of competent jurisdiction.

4. Representations and Warranties. Debtor represents and warrants the following:

4.1 Debtor has the power and is duly authorized to enter into and perform this Agreement, and Debtor has complied with and is in good standing with respect to all laws, statutes and ordinances of all federal, state and local governmental entities having jurisdiction over them. Debtor hereby represents and warrants that this Agreement is a legal, valid and binding agreement, enforceable in accordance

with its terms and shall be binding upon Debtor and its respective representatives, successors and assigns.

4.2 Debtor represents, warrants and covenants that it has valid title to all of the Collateral being turned over herewith.

5. [Intentionally Omitted].

6. **Representation by Counsel**. Debtor acknowledges that it has been represented by legal counsel of its choice, Jamie R. Pierce of Hinshaw & Culbertson, LLP, in connection with the execution and delivery of this Agreement.

7. **Notices**. Any notice required or permitted under this Agreement shall be in writing and shall be deemed to be given when and if sent by certified mail, return receipt requested, postage pre-paid, properly addressed as follows, or such other address as may hereafter be designated in writing by either of the parties:

Secured Party:

Roy Lecy
c/o Nathan M. Brandenburg
Siegel Brill, P.A.
100 Washington Avenue South, Suite 1300
Minneapolis, MN 55401

Debtor:

Aqua Innovations Incorporated
6101 Baker Road, Suite 206
Minnetonka, MN 55345

With a copy to:

Jamie R. Pierce
Hinshaw & Culbertson, LLP
333 South Seventh Street, Suite 2000
Minneapolis, MN 55402

8. **Amendments, Waivers, Assignment**. No amendment, waiver or assignment of the provisions of this Agreement shall be effective unless the same shall be in writing and be signed by the party against whom it is to be enforced, and then such amendment, waiver or assignment shall be effective only in the specific interest and for the specific purpose which given.

9. **Necessary Documents**. The parties agree that they shall execute any and all documents necessary to carry out the terms and conditions of this Agreement.

10. **Governing Law; Venue**. This Agreement shall be governed and construed under and in accordance with the laws of the State of Minnesota. Any dispute arising under this Agreement

and/or between the parties shall be venued in the state and federal courts located in Minneapolis, Minnesota.

11. Entire Agreement. This Agreement contains the entire Agreement by and between the parties hereto with respect to the transactions contemplated herein, which shall supersede any prior oral negotiations and agreements and shall be binding upon the parties hereto and their successors and assigns.

12. Merger. All prior oral and written communications, commitments, alleged commitments, promises, alleged promises, agreements and alleged agreements by or between Secured Party and Debtor are hereby merged into this Agreement.

13. Severability. If any part of this Agreement is held to be illegal, invalid or unenforceable, the remainder of this Agreement shall continue in full force and effect, notwithstanding such illegality, invalidity or unenforceability.

14. Headings. The section headings in this Agreement are included herein for convenience or reference only and shall not constitute a part of this Agreement for any other purposes.

15. Successors and Assigns. This Agreement shall be binding upon and shall inure to the benefit of the parties hereto and their respective successors and assigns, except that Debtor may not assign or transfer its rights or obligations hereunder without the prior written consent of Secured Party.

16. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed to be an original and all of which shall constitute one and the same instrument.

17. Indemnification. Debtor agrees to indemnify, defend and hold Secured Party, his respective employees, agents, representatives and attorneys harmless from any claim or cause of action (except for a claim of fraud against Secured Party) by any third party based in whole or in part upon the terms of this Agreement or their actions or omissions in fulfilling or enforcing this Agreement or based upon any failure by Debtor to pay all taxes, or other indebtedness or fulfill any obligations they may have with other third parties which may be affected by this Agreement or the omissions or actions of the parties relative thereto.

[This space intentionally left blank; signature page follows.]

IN WITNESS WHEREOF, Secured Party and Debtor hereto have executed this Agreement as of the Effective Date.

Debtor: **Aqua Innovations Incorporated**

By: Janel J. Fish
Its: chief executive officer

STATE OF MINNESOTA)
) ss.
COUNTY OF HENNEPIN)

This document was acknowledged before me on October 4, 2012, by Janel Fish, as Chief Executive Officer of Aqua Innovations Incorporated, a Minnesota corporation.

Notary Stamp:

LAURIE LYNN HONZA
Notary Public-Minnesota
My Commission Expires Jan 31, 2015

Laurie Honza
Notary Signature

Secured Party:

Roy H. Lecy

STATE OF MINNESOTA)
) ss.
COUNTY OF HENNEPIN)

This document was acknowledged before me on September ____, 2012, by Roy H. Lecy, an individual resident of the State of Minnesota.

Notary Stamp:

Notary Signature

M:\26141-001\Strict Foreclosure Agreement 05

IN WITNESS WHEREOF, Secured Party and Debtor hereto have executed this Agreement as of the Effective Date.

Debtor: **Aqua Innovations Incorporated**

By: _____
Its: _____

STATE OF MINNESOTA)
) ss.
COUNTY OF HENNEPIN)

This document was acknowledged before me on September ____, 2012, by _____, as _____ of Aqua Innovations Incorporated, a Minnesota corporation.

Notary Stamp:

_____
Notary Signature

Secured Party:

Roy H. Lecy

STATE OF MINNESOTA)
) ss.
COUNTY OF HENNEPIN)

This document was acknowledged before me on ~~September~~ October 8, 2012, by Roy H. Lecy, an individual resident of the State of Minnesota.

Notary Stamp:

TARI K. HAUNTY
Notary Public-Minnesota
My Commission Expires Jan 31, 2015

Tari K. Haunty
Notary Signature

M:\26141-001\Strict Foreclosure Agreement 05

EXHIBIT A
LICENSE AGREEMENT

EXHIBIT A
LICENSE AGREEMENT

AMENDMENT TO LICENSE AGREEMENT

THIS AMENDMENT TO LICENSE AGREEMENT (the "Amendment"), is made, entered into and effective as of October 4, 2012, by and between OXYGENATOR WATER TECHNOLOGIES, INC. ("Licensor"), a Minnesota corporation doing business as Water D.O.G. Works, and ROY H. LECY ("Lecy"), and amends certain terms of that certain License Agreement dated July 30, 2008 (the "License Agreement"), entered into by and between Licensor and Aqua Innovations Incorporated ("Aqua"), a Minnesota corporation. Licensor and Lecy may be individually referred to herein as a "party" or collectively as the "parties."

WHEREAS, Licensor, as Licensor, and Aqua, as Licensee, entered into the License Agreement on or about July 30, 2008, a copy of which is attached hereto as Exhibit A; and

WHEREAS, pursuant to an Agreement of Strict Foreclosure dated October 4, 2012, Aqua conveyed all right, title and interest it held in the License Agreement to Lecy; and

WHEREAS, the parties desire to formally amend the License Agreement to reflect Lecy's interest in the Agreement via this Amendment.

NOW THEREFORE, it is hereby agreed as follows:

1. **Incorporation of Recitals**. The recitals set forth above are true and correct and incorporated as if fully stated herein.

2. **Amendment of License Agreement**. All references in the License Agreement to Licensee shall mean Roy H. Lecy and not Aqua. Licensor hereby acknowledges the acquisition by Lecy of all right, title and interest of Aqua in the License Agreement and further acknowledges and agrees that the License Agreement is a binding contract in full force and effect and that Lecy may assign his interest therein at will.

3. **Remaining Terms in Full Force and Effect**. No other terms of the License Agreement or any schedule or exhibit thereto shall be amended or modified in any way and the License Agreement shall remain in full force and effect as amended via this Amendment and the parties hereby reaffirm their respective obligations thereunder.

Oxygenator Water Technologies, Inc.

By: Mark A. Rolfes
Its: President
10-24-2012

Roy H. Lecy

PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	LICENSE

CONVEYING PARTY DATA

Name	Execution Date
Roy H Lecy	10/04/2012

RECEIVING PARTY DATA

Name:	O2 Marine Technologies, Inc.
Street Address:	6651 Hazeltine Boulevard
City:	Excelsior
State/Country:	MINNESOTA
Postal Code:	55331

PROPERTY NUMBERS Total: 3

Property Type	Number
Patent Number:	6689262
Patent Number:	7396441
Patent Number:	7670495

CH $120.00 6689262

CORRESPONDENCE DATA

Fax Number: 6123396591
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 6123376100
Email: nathanbrandenburg@siegelbrill.com
Correspondent Name: Nathan M. Brandenburg
Address Line 1: 100 Washington Avenue South
Address Line 2: Suite 1300
Address Line 4: Minneapolis, MINNESOTA 55401

ATTORNEY DOCKET NUMBER:	25991-002
NAME OF SUBMITTER:	Nathan M. Brandenburg
Signature:	/nathanmbrandenburg/

Date:	04/30/2013
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 5
source=Patent Sublicense Agreement#page1.tif
source=Patent Sublicense Agreement#page2.tif
source=Patent Sublicense Agreement#page3.tif
source=Patent Sublicense Agreement#page4.tif
source=Patent Sublicense Agreement#page5.tif

PATENT SUBLICENSE AGREEMENT

THIS PATENT SUBLICENSE AGREEMENT (this "Agreement") is made, entered into and effective as of October 4, 2012 (the "Effective Date") by and between ROY H. LECY ("Sublicensor"), a Minnesota resident, and O2 MARINE TECHNOLOGIES, INC. ("Sublicensee"), a Minnesota corporation. Sublicensor or Sublicensee may be individually referred to herein as a "party" or collectively as the "parties."

WHEREAS, Sublicensor is the holder of certain patent licenses as set forth in a certain License Agreement dated July 30, 2008, entered into by and between Oxygenator Water Technologies, Inc. ("OWT"), as Licensor, and Aqua Innovations Incorporated ("Aqua"), as Licensee (the "License Agreement"), as amended via a certain Amendment to License Agreement dated October 4, 2012 (the "Amendment" or collectively with the License Agreement, the "License Agreement"), pursuant to which Roy H. Lecy acquired all right title and interest of Aqua in the License Agreement; and

WHEREAS, copies of the License Agreement and Amendment are attached hereto as Exhibit A.

NOW THEREFORE, the parties hereby agree as follows:

ARTICLE ONE
GRANT OF SUBLICENSE

1.1 **License**. Sublicensor warrants he holds a valid license pursuant to the License Agreement for United States Patent Number 6,689,262 B2 issued on February 10, 2004, entitled "Microbubbles of oxygen," United States Patent Number 7,396,441 B2 issued on July 8, 2008, entitled "Flow-through oxygenator," and United States Patent Number 7,670,495 issued on March 2, 2010, entitled "Flow-through oxygenator" (collectively, the "Licensed Patents" or each a "Licensed Patent").

1.2 **Grant of Sublicense**. Effective upon execution of this Agreement, and for consideration stated in Article Three of this Agreement, Sublicensor grants to Sublicensee a royalty based, limited, exclusive sublicense to make, sell, and offer for sale products covered by the Licensed Patents in the United States and to sell and offer for sale in any country products covered by the Licensed Patents (the "Licensed Products"), subject to the limitations set forth in this Agreement. The Licensed Patents are sublicensed "As Is" and without warranty of any kind by Sublicensor.

ARTICLE TWO
LICENSED FIELD

2.1 **Licensed Field**. Sublicensee may sell and offer for sale only Licensed Products manufactured for retail sale and use in the sport fishing industry (the "Licensed Field") and for no other purposes. Sublicensee hereby agrees to offer for sale and to sell only the Licensed Products in the Licensed Field. Sublicensee acknowledges and agrees that if Sublicensee offers for sale or sells the Licensed Products outside the Licensed Field such activity by Sublicensee will be deemed a material breach of this Agreement and Sublicensor shall have the right to terminate this Agreement without notice.

ARTICLE THREE
ROYALTY

3.1 Royalty. Sublicensee shall pay royalties to Sublicensor at a rate of five percent (5%) of the net receipts realized by Sublicensee upon any Licensed Products sold by Sublicensee. For purposes of this Agreement, "net receipts" shall mean gross sale proceeds, less cost of goods sold, freight, discounts offered by Sublicensee, returns and other costs or expenses incurred by Sublicensee in the manufacture and sale of the Licensed Products. Any royalties shall be paid to Sublicensor on a calendar quarterly basis, sixty (60) days after the end of each calendar quarter (May 30, August 30, December 30 and March 1 or 2).

3.2 Accounting. For all Licensed Products sold by Sublicensee, Sublicensee will account to Sublicensor on a calendar quarterly basis, indicating the number of Licensed Products sold within thirty (30) days following the end of each calendar quarter for the term hereof. Sublicensee shall make such accountings to Sublicensor via paper or electronic accounting statements in a mutually accepted compatible format. Sublicensee agrees to keep and maintain true and accurate records and books of account in connection with all sales related to any such products and all transactions related thereto or otherwise contemplated under this Agreement, and shall retain all such records and books for a period of not less than five (5) years after each accounting to Sublicensor. Sublicensor, by its designated representative, shall have the right, upon reasonable written notice, and during normal office hours, to examine the books and records of Sublicensee, as the same pertain to the subject matter of this Agreement, and to make copies and extracts thereof. Sublicensee shall cooperate with Sublicensor's representatives to assist them in understanding all such material. If, as a result of any audit, it is determined that Sublicensee has understated the royalties due to Sublicensor by ten percent (10%) or more, Sublicensee shall pay to Sublicensor the amount by which royalties have been understated plus a ten percent (10%) penalty fee, and shall reimburse Sublicensor for the cost of the audit.

ARTICLE FOUR
PACKAGING

4.1 Packaging. Sublicensee shall use its own tradename or trade or servicemark on the packaging for the Licensed Products. In no event shall Sublicensee use any of Sublicensor's trademarks on the packaging for the Licensed Products.

ARTICLE FIVE
LICENSED PRODUCT REVIEW

5.1 Licensed Product Review. Sublicensor shall have the right to review the Licensed Products and packaging for the Licensed Products to be sold or offered for sale by Sublicensee prior to first sale of the Licensed Products and thereafter on a quarterly basis. Sublicensor shall have the right to provide suggestions concerning the quality and design of the Licensed Products, including packaging, to be sold or offered for sale by Sublicensee. If Sublicensor determines the quality of Licensed Products and/or packaging on the Licensed Products is unacceptable to Sublicensor, Sublicensor shall work with Sublicensee and offer suggestions to make the Licensed Products suitable and ready for market. Sublicensor and Sublicensee shall be willing to mutually work together in a reasonable manner without undue restriction.

ARTICLE SIX
MARKETING

6.1 Marketing. Sublicensee shall mark all Licensed Products made, used or sold under the terms of this Agreement with the following: "Protected by U.S. Patent Nos. 6,689,262, 7,396,441 and 7,670,495. Other Patents Pending."

ARTICLE SEVEN
TERM

7.1 Term. The sublicense so granted pursuant to this Agreement shall be effective from the Effective Date and shall terminate with respect to a Licensed Patent on the expiration of the Licensed Patent, subject to Section 7.2 of this Agreement.

7.2 Termination. Notwithstanding Section 7.1 of this Agreement, this Agreement shall terminate:

7.2.1 Upon the mutual agreement of the parties;

7.2.2 Upon ten (10) days' written notice from Sublicensor to Sublicensee upon Sublicensee's failure to pay any royalty due and owing Sublicensor;

7.2.3 Immediately if Sublicensee files of a petition of bankruptcy, or a petition or answer seeking reorganization, readjustment or rearrangement of its business or affairs under any law or governmental regulation relating to bankruptcy or insolvency;

7.2.4 Immediately if in Sublicensor's reasonable business judgment Sublicensee undertakes any action that derogates, disparages or impairs any of the Licensed Patents;

7.2.5 Immediately upon the terms of Section 2.1 of this Agreement; or

7.2.6 Upon ninety (90) days' written notice from Sublicensor to Sublicensee if Sublicensee fails to actively sell any Licensed Products or otherwise fails to actively and diligently utilize the sublicense granted by this Agreement.

ARTICLE EIGHT
INFRINGEMENT

8.1 Notice. Sublicensee shall inform Sublicensor within thirty (30) days and in writing of any alleged infringement of the Licensed Patents by a third party.

8.2 Legal Action; Mutual Cooperation. Sublicensor shall have the right, but shall not be obligated, to prosecute at its own expense any infringement of the Licensed Patents and, in furtherance of such right, Sublicensee hereby agrees that Sublicensor may, if required by law or otherwise, include Sublicensee as a party plaintiff in any such suit, without expense to

Sublicensee. The total cost of any such infringement action commenced or defended solely by Sublicensor shall be borne by Sublicensor, and Sublicensor shall keep any recovery or damages. In the event that any action alleging invalidity, non-enforceability, or non-infringement of any of the Licensed Patents shall be brought by a third party, Sublicensor, at its option, shall have the right to defend such actions.

ARTICLE NINE
INDEMNIFICATION

9.1 Indemnification. Sublicensee shall indemnify, defend, and hold harmless Sublicensor from any and all actions, claims, suits, losses, liabilities, damages, costs, fees, and expenses (including attorney fees) resulting from or arising out of the exercise of the Sublicensee's rights granted under this Agreement. This indemnification shall include, but is not limited to, any and all actions alleging product liability, patent infringement, or other type of intellectual property matter.

ARTICLE TEN
GENERAL TERMS

10.1 Assignment. The rights and sublicenses granted by Sublicensor in this Agreement are personal to Sublicensee and may not be assigned or otherwise transferred without the written consent of Sublicensor. Sublicensor may provide such consent upon request from Sublicensee for any assignment to a third party who is acquiring substantially all of the business assets of Sublicensee, but Sublicensor reserves the right to deny consent if the third party is a competitor of Sublicensor.

10.2 Sublicense. The rights and license granted by Sublicensor in this Agreement may not be sublicensed by Sublicensee without the written consent of Sublicensor.

10.3 Confidentiality. Sublicensor and Sublicensee both agree the terms of this Agreement are confidential and shall not be disclosed to any third party.

10.4 Governing Law. This Agreement shall be construed and enforced according to the laws of the State of Minnesota. Any disputes arising out of, under, or relating to the negotiation, drafting, execution, validity, interpretation, breach, or enforcement of this Agreement shall be venued in the state or federal courts located in Minneapolis, Minnesota.

10.5 Entire Agreement. Sublicensee and Sublicensor acknowledge receipt of this Agreement and agree that with respect to the subject matter hereof this Agreement is the entire agreement of the parties and supersedes any previous oral or written communications or understandings, and that each provision has been given due consideration and accepted without duress.

10.6 Attorneys' Fees. In the event that any proceeding, suit or action is brought by any party under this Agreement to enforce any of its terms, it is agreed that the prevailing party shall be entitled to reasonable attorneys' fees to be fixed by the trial and appellate courts in any such proceeding or as incurred in the collection of any judgment.

10.7 Counterparts. This Agreement may be signed in counterparts by the parties hereto with the same force and effect as if the above parties signed the same original agreement. Facsimile and electronic copies and photocopies of the parties' signatures to this Agreement shall be valid and enforceable to the same extent as original signatures and the parties hereby waive any requirement that original signatures be produced as a condition of proving the validity of or otherwise enforcing this Agreement

IN WITNESS WHEREOF, Sublicensor and Sublicensee have executed this Agreement as of the Effective Date.

Sublicensor:

Roy H. Lecy

Sublicensee:

O2 MARINE TECHNOLOGIES, INC.

By: Dennis Clark
Its: President

PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Aqua Innovations, Inc.	10/04/2012

RECEIVING PARTY DATA

Name:	Roy H Lecy
Street Address:	2640 North Saunders Lake Drive
City:	Minnetrista
State/Country:	MINNESOTA
Postal Code:	55364

PROPERTY NUMBERS Total: 3

Property Type	Number
Patent Number:	6689262
Patent Number:	7396441
Patent Number:	7670495

CH $120.00 6689262

CORRESPONDENCE DATA

Fax Number: 6123396591
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 612-337-6100
Email: nathanbrandenburg@siegelbrill.com
Correspondent Name: Nathan M. Brandenburg
Address Line 1: 100 Washington Avenue South
Address Line 2: Suite 1300
Address Line 4: Minneapolis, MINNESOTA 55446

ATTORNEY DOCKET NUMBER:	26141-001
NAME OF SUBMITTER:	Nathan M. Brandenburg
Signature:	/nathanmbrandenburg/

Date:	04/30/2013
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 27
source=License Amendment - Signed#page1.tif
source=OWT - Aqua License#page1.tif
source=OWT - Aqua License#page2.tif
source=OWT - Aqua License#page3.tif
source=OWT - Aqua License#page4.tif
source=OWT - Aqua License#page5.tif
source=OWT - Aqua License#page6.tif
source=OWT - Aqua License#page7.tif
source=OWT - Aqua License#page8.tif
source=OWT - Aqua License#page9.tif
source=OWT - Aqua License#page10.tif
source=OWT - Aqua License#page11.tif
source=OWT - Aqua License#page12.tif
source=OWT - Aqua License#page13.tif
source=OWT - Aqua License#page14.tif
source=OWT - Aqua License#page15.tif
source=OWT - Aqua License#page16.tif
source=OWT - Aqua License#page17.tif
source=OWT - Aqua License#page18.tif
source=OWT - Aqua License#page19.tif
source=OWT - Aqua License#page20.tif
source=OWT - Aqua License#page21.tif
source=OWT - Aqua License#page22.tif
source=OWT - Aqua License#page23.tif
source=OWT - Aqua License#page24.tif
source=OWT - Aqua License#page25.tif
source=OWT - Aqua License#page26.tif

AMENDMENT TO LICENSE AGREEMENT

THIS AMENDMENT TO LICENSE AGREEMENT (the "Amendment"), is made, entered into and effective as of October 4, 2012, by and between OXYGENATOR WATER TECHNOLOGIES, INC. ("Licensor"), a Minnesota corporation doing business as Water D.O.G. Works, and ROY H. LECY ("Lecy"), and amends certain terms of that certain License Agreement dated July 30, 2008 (the "License Agreement"), entered into by and between Licensor and Aqua Innovations Incorporated ("Aqua"), a Minnesota corporation. Licensor and Lecy may be individually referred to herein as a "party" or collectively as the "parties."

WHEREAS, Licensor, as Licensor, and Aqua, as Licensee, entered into the License Agreement on or about July 30, 2008, a copy of which is attached hereto as Exhibit A; and

WHEREAS, pursuant to an Agreement of Strict Foreclosure dated October 4, 2012, Aqua conveyed all right, title and interest it held in the License Agreement to Lecy; and

WHEREAS, the parties desire to formally amend the License Agreement to reflect Lecy's interest in the Agreement via this Amendment.

NOW THEREFORE, it is hereby agreed as follows:

1. **Incorporation of Recitals**. The recitals set forth above are true and correct and incorporated as if fully stated herein.

2. **Amendment of License Agreement**. All references in the License Agreement to Licensee shall mean Roy H. Lecy and not Aqua. Licensor hereby acknowledges the acquisition by Lecy of all right, title and interest of Aqua in the License Agreement and further acknowledges and agrees that the License Agreement is a binding contract in full force and effect and that Lecy may assign his interest therein at will.

3. **Remaining Terms in Full Force and Effect**. No other terms of the License Agreement or any schedule or exhibit thereto shall be amended or modified in any way and the License Agreement shall remain in full force and effect as amended via this Amendment and the parties hereby reaffirm their respective obligations thereunder.

Oxygenator Water Technologies, Inc.

By: Mark A. Rolfes
Its: President
10-24-2012

Roy H. Lecy

License Agreement

THIS AGREEMENT ("Agreement") is entered into this 30th day of July, 2008 (the "Effective Date"), by and between Oxygenator Water Technologies, Inc., a Minnesota corporation with offices at 6101 Baker Rd., #206, Minnetonka, Minnesota, 55435 ("Licensor") and Aqua Innovations, Inc. a Minnesota corporation with offices at 6101 Baker Rd., #206, Minnetonka, Minnesota, 55435 ("Licensee", and Licensor and Licensee each a "Party" and together the "Parties"). Initially capitalized terms defined in this Agreement shall have the meaning ascribed to them respectively herein.

WITNESSETH:

LICENSOR owns the technology for which patents have been issued and are pending with respect to electrolytic hydrolysis of water to increase its dissolved oxygen content. A more complete description of said technology, together with a description of the patents issued and currently pending for said technology, is set forth in Article 1 below and in Exhibit "A" attached hereto.

LICENSOR anticipates and intends that it will make additional discoveries and improvements to said technology, some of which may be patentable.

It is further anticipated by the parties that LICENSOR may make improvements to said technology and additional discoveries concerning other applications for said technology.

The parties desire that LICENSOR grant a perpetual, exclusive license to LICENSEE to develop and sell throughout the world certain products utilizing the technology LICENSOR has developed and may in the future develop, all according to the terms and conditions set forth in this Agreement.

The parties further desire that LICENSOR will retain the complete and entire right to develop and sell throughout the world in markets not licensed to LICENSEE hereunder products utilizing the technology LICENSOR has developed and may in the future develop or the technology that LICENSEE may develop in the future, also according to the terms and conditions set forth in this Agreement.

Thus, the parties have agreed to enter into a licensing arrangement by which each party will be entitled to benefit from the other party's patents, technology and know-how concerning electrolytic hydrolysis of water in the sale of products in certain markets.

NOW, THEREFORE, based on the foregoing and the mutual covenants and agreements herein contained, the parties hereby covenant and agree as follows:

EXHIBIT "B"

LICENSEE Markets

All worldwide markets for:

- Waste Water Treatment
- Medical Applications
- Sport Fishing
- Aqua Culture
- Horticulture (consumer and commercial)
- Hydroponics

Markets excluded from license agreement (including but not limited to):

- Water Treatment (all applications except waste water)
- Fermentation
- Desalination
- Human Nutrition
- Animal Nutrition

ARTICLE 1
DEFINITIONS

When used in this Agreement, the following terms have the meanings set forth below unless a different and common meaning of the term is clearly indicated by the context, and variants and derivatives of the following terms shall have correlative meanings:

"***Agreement***" has the meaning set forth in the preamble.

"***LICENSOR Documents***" has the meaning set forth in Section 2.6.

"***LICENSOR Improvements***" means all developments LICENSOR may make in the LICENSOR Technology or the LICENSEE Technology prior to the termination of this Agreement, whether or not patentable, and which are invented, developed, discovered or otherwise acquired by LICENSOR and which LICENSOR may lawfully communicate to LICENSEE.

"***LICENSOR Markets***" means all uses for the LICENSOR Technology and the LICENSEE Technology other than in the LICENSEE Markets.

"***LICENSOR Patents***" means all of LICENSOR's patents (whether issued to LICENSOR or controlled by license rights or otherwise and whether such rights are held alone or jointly with others, and patents pending now, or during the term of this Agreement, issued to LICENSOR (by any country) relating to the LICENSOR Technology, including, but not limited to, those patents and those patents pending described on Exhibit A and any continuations, continuations-in-part, divisions, registrations, confirmations, reissues, renewals or extensions of term thereof.

"***LICENSOR Products***" means any product manufactured and/or sold or distributed by LICENSOR or a sub licensee of LICENSOR under any claim contained in the LICENSEE Patents.

"***LICENSOR Property***" means LICENSOR Patents, LICENSOR Improvements and LICENSOR Technology.

"***LICENSOR Technology***" means LICENSOR's unpatented technology and information now existing and relating to, and embodying LICENSOR's experience in electrolytic hydrolysis of water. LICENSOR Technology shall include the technical information in all current and future manuals, formulae, specifications, test data and procedures, flow charts, apparatus plans, drawings, designs and other information actually communicated by LICENSOR to LICENSEE during the term of this Agreement, whether contained in documentary form, electronic medium or communicated as a result of LICENSOR imparting the same directly or giving LICENSEE access to any of LICENSOR's production facilities.

"***Effective Date***" has the meaning set forth in the preamble.

"***LICENSEE Documents"*** has the meaning set forth in Section 2.7.

"***LICENSEE Improvements***" means all developments LICENSEE may make in the LICENSOR Technology or the LICENSEE Technology prior to the termination of this Agreement, whether or not patentable and which are invented, developed, discovered or otherwise acquired by LICENSEE and which LICENSEE may lawfully communicate to LICENSOR.

"***LICENSEE Markets***" means those markets for Licensee Products as are described in Exhibit B attached hereto.

"***LICENSEE Patents***" means all of LICENSEE's patents (whether issued to LICENSEE or controlled by license rights or otherwise and whether such rights are held alone or jointly with others) which may after the effective date of this Agreement be issued (by any country) relating to electrolytic hydrolysis of water and any continuations, continuations-in-part, divisions, registrations, confirmations, reissues, renewals or extensions of term thereof.

"***LICENSEE Products***" means any product manufactured and/or sold or distributed to any party other than LICENSOR by LICENSEE or a sublicense of LICENSEE in conformity with the terms of this Agreement, including, but not limited to, any product which is based on any claim or thing contained in any LICENSOR Property.

"***LICENSEE Property***" means LICENSEE Patents, LICENSEE Improvements and LICENSEE Technology.

"***LICENSEE Technology***" means LICENSEE's unpatented technology and information which LICENSEE may develop relating to, and embodying LICENSEE's experience in, the manufacturing, the processing, quality control, and sale of the LICENSEE Products. LICENSEE Technology shall include the technical information in all manuals, formulae, specifications, test data and procedures, flow charts, apparatus plans, drawings, designs and other information actually communicated by LICENSEE to LICENSOR during the term of this Agreement, whether contained in documentary form, electronic medium or communicated as a result of LICENSEE imparting the same directly or giving LICENSOR access to any of LICENSEE's production facilities.

"***Territory***" means the world.

ARTICLE 2
MARKETS AND LICENSING

2.1. Exclusive Markets. The parties agree that unless properly terminated by LICENSOR pursuant to Section 5.1 below, LICENSEE will have the exclusive right to exploit the LICENSOR Property and the LICENSEE Property in the manufacture, use and sale or other distribution of LICENSEE Products in the LICENSEE Markets in the Territory. The parties further agree that LICENSOR will have the exclusive right to exploit the LICENSOR Property and the LICENSEE Property in the manufacture, use and sale or other distribution of LICENSOR Products in the LICENSOR Markets in the Territory. LICENSEE may not, directly or indirectly, distribute in any manner any product which competes with the LICENSEE Products in any manner nor may LICENSEE assist or have any interest in any third party distributing any such products through licensing or assignment of technology to any such third party or by any other means.

2.2. Exclusive License to LICENSEE. Subject to the terms and conditions of this Agreement, LICENSOR hereby confers upon LICENSEE the sole and exclusive license, with the right of sublicense, under the LICENSOR Property, to make, have made, use and sell the LICENSEE Products in the LICENSEE Markets in the Territory and to prevent infringement of the LICENSOR Patents, and to prevent unauthorized use and disclosure of the LICENSOR Technology in connection therewith. No license is conferred hereby to make, have made, use and sell articles which are not LICENSEE Products.

2.3. Exclusive License to LICENSOR. Subject to the terms and conditions of this Agreement, LICENSEE hereby confers upon LICENSOR the sole and exclusive, royalty-free license, with the right of sublicense, under the LICENSEE Property, to make, have made, use and sell the LICENSOR Products in the LICENSOR Markets in the Territory and to prevent infringement of the LICENSEE Patents, and to prevent unauthorized use and disclosure of the LICENSEE Technology in connection therewith. No license is conferred hereby to make, have made, use and sell articles which are not LICENSOR Products.

2.4. Product Markings. The Parties shall insure that all LICENSOR Products and all LICENSEE Products are marked with any applicable patent number and all labeling and other product information shall be marked in such manner as to conform with the patent laws and practices of the country of sale.

2.5 Transfer of Technology by LICENSOR. As promptly as practicable after the execution of this Agreement, LICENSOR shall deliver to LICENSEE all information concerning the LICENSOR Property. LICENSOR also promptly shall deliver to LICENSEE all future information it acquires concerning the LICENSOR Property. All documentary information so delivered or any documentary information following non-documentary disclosure by LICENSOR, shall be referred to as "LICENSOR Documents". LICENSEE shall receive, use, maintain, restrict access to or copying of, and safeguard the LICENSOR Documents in such manner as to maximize the value of the LICENSOR Patents, the LICENSOR Technology and the LICENSOR Improvements; without limiting the generality of the foregoing, LICENSEE shall, and shall cause its employees and

representatives to, use reasonable care to prevent unauthorized access to, copying, use, publication, disclosure or other dissemination of the LICENSOR Documents. Upon 10 days advance notice and at reasonable times, LICENSOR shall permit LICENSEE access to its technical personnel at its offices or at such locations as is mutually agreed upon by the Parties. During such visits, technically competent personnel will be provided by LICENSOR to answer fully such questions as LICENSEE may have with a view to transferring the LICENSOR Property. Nothing in this Section 2.6 shall require LICENSOR to disclose to LICENSEE any technological information which it does not own or that is otherwise subject to restrictions on use or disclosure.

2.6. Transfer of Technology by LICENSEE. As promptly as practicable after LICENSEE develops, discovers or otherwise comes into possession of LICENSEE Patents, LICENSEE Improvements and/or LICENSEE Technology, LICENSEE shall deliver to LICENSOR all information concerning same. All documentary information so delivered or any documentary information following non-documentary disclosure by LICENSEE, shall be referred to as "LICENSEE Documents." LICENSOR shall receive, use, maintain, restrict access to or copying of, and safeguard the LICENSEE Documents in such manner as to maximize the value of the LICENSEE Patents, the LICENSEE Technology and the LICENSEE Improvements; without limiting the generality of the foregoing, LICENSOR shall, and shall cause its employees and representatives to, use reasonable care to prevent unauthorized access to, copying, use, publication, disclosure or other dissemination of the LICENSEE Documents. Upon 10 days advance notice and at reasonable times, LICENSEE shall permit LICENSOR access to its technical personnel at its offices or at such locations as is mutually agreed upon by the Parties. During such visits, technically competent personnel will be provided by LICENSEE to answer fully such questions as LICENSOR may have with a view to transferring to LICENSOR the LICENSEE Property. Nothing in this Section 2.7 shall require LICENSEE to disclose to LICENSOR any technological information which it does not own or that is otherwise subject to restrictions on use or disclosure.

2.7. Further Prosecution of Patents. LICENSOR will continue with the prompt prosecution of all pending patent applications filed by LICENSOR as detailed on Schedule "A", so long as it is commercially reasonable to do so, and LICENSOR will periodically advise LICENSEE of the status of such prosecutions. As soon as practical, the Parties will confer to determine the countries for which the Parties desire protection for the LICENSOR Patents. In the event that LICENSEE files an application for a patent(s) covering electrolytic hydrolysis of water, LICENSEE will periodically advise LICENSOR of the status of the prosecution of any such patent. As soon as practical after any such application by LICENSEE, the Parties will confer to determine the countries for which the Parties desire protection for the LICENSEE Patents. From the date of this Agreement, all expenses incurred in filing for and maintaining protection in those countries mutually agreed upon (other than expenses of prosecuting the original patent application in the first jurisdiction, which will be the responsibility of the Party filing the patent application) will be shared equally by the Parties. Either Party may seek protection in any country not mutually agreed upon by paying the full amount of the cost thereof. A party seeking such additional protection will receive the full cooperation of the other Party (other than in paying the expenses thereof) in protecting all patents in any such other country.

2.8. Additional Covenants. Each of LICENSOR and LICENSEE shall faithfully comply with their respective obligations under this Agreement and shall incorporate all terms and conditions required by this Agreement in any contracts with third parties to whom access to the LICENSOR Property or the LICENSEE Property, as the case may be, may (but only in accordance with this Agreement) be given. Each of LICENSOR and LICENSEE shall indemnify and hold harmless the other Party and its successors and assigns from any injury, loss, or damage of any kind or nature, or any other liability sought to be imposed on such Party, and arising out of or in connection with or resulting from the marketing, sale or use of the imdemnifying Party's product(s), including any advertising or other promotional activities related thereto.

2.9. Infringement Actions. Neither LICENSOR nor LICENSEE will have any responsibility to the other Party for any damage or expense incurred by such other Party which arises from any action, claim or cause of action brought by any person as the result of any alleged patent infringement or trade secret misappropriation by reason of such other Party's manufacture, use or sale of any product under any of the licenses conferred hereby.

2.10. LICENSEE's Rights in Event of Third Party Infringement. LICENSEE shall have the right, in LICENSOR's name (if required by law, otherwise, in LICENSEE's name) but at LICENSEE's sole expense, to sue third parties in the LICENSEE Markets for infringements of the LICENSOR Patents and misappropriation of the LICENSOR Technology and unpatented LICENSOR Improvements, and LICENSOR shall, but at LICENSEE's expense for LICENSOR's direct associated expenses, fully and promptly cooperate and assist LICENSEE in connection with any such suit. LICENSEE shall promptly reimburse LICENSOR for said suit-associated direct expenses upon presentation of LICENSOR's itemized statement therefor. LICENSOR may, if it so elects, join in any such suit as a plaintiff. All damages, awards or settlement proceeds in such suit shall be LICENSEE's. If LICENSEE, after notice from LICENSOR of an alleged infringement or misappropriation, shall within 90 days fail to institute suit, LICENSOR, in its own name (or, if required by law, in its and LICENSEE's name) and at its own expense, may sue therefore, and LICENSEE shall, but at LICENSOR's expense for LICENSEE's direct associated expenses, fully and promptly cooperate and assist LICENSOR in connection with any such suit. LICENSOR shall promptly reimburse LICENSEE for said suit-associated direct expenses upon presentation of LICENSEE's itemized statement therefor. All damages, awards or settlement proceeds in such suit shall be LICENSOR's.

2.11. LICENSOR's Rights in Event of Third Party Infringement. LICENSOR shall have the right, in LICENSEE's name (if required by law, otherwise, in LICENSOR's name) but at LICENSOR's sole expense, to sue third parties in the LICENSOR Markets for infringements of the LICENSEE Patents and misappropriation of the LICENSEE Technology and unpatented LICENSEE Improvements, and LICENSEE shall, but at LICENSOR's expense for LICENSEE's direct associated expenses, fully and promptly cooperate and assist LICENSOR in connection with any such suit. LICENSEE may, if it so elects, join in any such suit as a plaintiff. LICENSOR shall promptly reimburse LICENSEE for said suit-associated direct expenses upon presentation of LICENSEE's itemized

statement therefor. All damages, awards or settlement proceeds in such suit shall be LICENSOR's. If LICENSOR, after notice from LICENSEE of an alleged infringement or misappropriation, shall within 90 days fail to institute suit, LICENSEE, in its own name (or, if required by law, in its and LICENSOR's name) and at its own expense, may sue therefore, and LICENSOR shall, but at LICENSEE's expense for LICENSOR's direct associated expenses, fully and promptly cooperate and assist LICENSEE in connection with any such suit. LICENSEE shall promptly reimburse LICENSOR for said suit-associated direct expenses upon presentation of LICENSOR's itemized statement therefor. All damages, awards or settlement proceeds in such suit shall be LICENSEE's.

2.12. LICENSEE Royalty Payment. None. License is granted without cost to LICENSEE.

ARTICLE 3
INDEMNIFICATION

3.1. Indemnification by LICENSEE. LICENSEE shall indemnify and hold LICENSOR and its successors and assigns harmless from any injury, loss, or damage of any kind or nature, or any other liability sought to be imposed on LICENSOR arising out of or in connection with or resulting from the marketing, sale or use of the LICENSEE Products, including any advertising or other promotional activities related thereto. LICENSOR shall be an added insured party to LICENSEE's product liability insurance, which shall have coverage limits of at least two million dollars ($2,000,000) per incident and which LICENSEE shall procure and have in place no later than the date on which LICENSEE first makes a delivery of any of the LICENSEE Products. Such policy of insurance shall provide that it may not be cancelled unless LICENSOR is provided at least thirty (30) days advance written notice.

3.2. Indemnification by LICENSOR. LICENSOR shall indemnify and hold LICENSEE and its successors and assigns harmless from any injury, loss, or damage of any kind or nature, or any other liability sought to be imposed on LICENSEE arising out of or in connection with or resulting from the marketing, sale or use of the LICENSOR Products, including any advertising or other promotional activities related thereto. At such time, if any, as LICENSOR shall sell LICENSOR Products, LICENSOR shall add LICENSEE as an added insured party to LICENSOR's product liability insurance, which shall have coverage limits of at least two million dollars ($2,000,000) per incident and which LICENSOR shall procure and have in place no later than the date on which LICENSOR first makes a delivery of any of the LICENSOR Products. Such policy of insurance shall provide that it may not be cancelled unless LICENSEE is provided at least thirty (30) days advance written notice.

ARTICLE 4
CONFIDENTIALITY

4.1. Restrictions on Use and Disclosure of LICENSOR Property by LICENSEE. LICENSEE shall use the LICENSOR Property in confidence and shall not

disclose same to its employees to whom access may be given in accordance with this Agreement until each such employee shall have previously agreed not to disclose such information. Restrictions on use and disclosure of any portion thereof shall terminate: (a) if that portion is, or becomes, generally known within the related trade or industry through no default of LICENSEE, or (b) upon the expiration of the obligation of LICENSEE under this Agreement to pay royalties to LICENSOR.

4.2. Restrictions on Use and Disclosure of LICENSEE Property by LICENSOR. LICENSOR shall use the LICENSEE Property in confidence and shall not disclose same to its employees to whom access may be given in accordance with this Agreement until each such employee shall have previously agreed not to disclose such information. Restrictions on use and disclosure of any portion thereof shall terminate if that portion is, or becomes, generally known within the related trade or industry through no default of LICENSOR.

4.3. Employees; Third Parties Etc. In order to faithfully perform their respective obligations under sections 4.1 and 4.2, the Parties shall limit access to the other Party's Property to only those of its officers, employees and agents who shall have a need to receive or have access to that portion, and then only for the purposes of the practice under the licenses conferred by this Agreement. Each Party will require any third party, to whom access may be authorized under this Agreement, to execute an appropriate confidentiality agreement.

4.4. Authorized Required Disclosures. Nothing in this Article 4 shall prevent a Party: (a) from complying (but only to the narrowest extent required by law and regulation and with due notice on any submissions to governmental agencies of the confidential or proprietary status of the information with a view toward restricting access to, and use or disclosure by, third parties) with reasonable requirements of governmental agencies to disclose information in order to receive legally required consents or permissions to manufacture or sell that Party's Products; or (b) from disclosing information under court order, but only after having made all reasonable efforts to secure the court's order to (i) limit production, use and disclosure of said information for the purposes of the case and to the narrowest class of disclosures practicable under the circumstances and (ii) hold all proceedings in camera with a sealed record.

ARTICLE 5
RESOLUTION OF DISPUTES

All claims, disputes and other matters in question arising out of, or relating to, this Agreement or the performance thereof shall be submitted to, and determined by, arbitration if good faith negotiations between the parties do not resolve such claim, dispute or other matter within 60 days. Such arbitration shall proceed in accordance with the Commercial Arbitration Rules of the American Arbitration Association then pertaining (the "Rules"), insofar as such Rules are not inconsistent with the provisions expressly set forth in this Agreement, unless the parties mutually agree otherwise, and pursuant to the following procedures:

(a) Notice of the demand for arbitration shall be filed in writing with the other Member and with the American Arbitration Association. Each Member shall appoint an arbitrator, and those party-appointed arbitrators shall appoint a third neutral arbitrator within 10 days. If the party-appointed arbitrators fail to appoint a third, neutral arbitrator within 10 days, such third, neutral arbitrator shall be appointed by the American Arbitration Association in accordance with the Rules. A determination by a majority of the panel shall be binding.

(b) Reasonable discovery shall be allowed in arbitration.

(c) All proceedings before the arbitrators shall be held in Minneapolis, Minnesota. The governing law shall be as specified in Section 8.1 below.

(d) The costs and fees of the arbitration, including attorneys' fees, shall be allocated by the arbitrators.

(e) The award rendered by the arbitrators shall be final and judgment may be entered in accordance with applicable law and in any court having jurisdiction thereof.

ARTICLE 6
NOTICES

6.1. Notices. All communications, demands, notices or objections required or permitted to be given or served under this Agreement shall be in writing and shall be deemed to have been duly given or made only if delivered in person, deposited in the United States mail, postage prepaid, for mailing by certified or registered mail, return receipt requested, or delivered by prepaid overnight courier service, addressed to the appropriate party as follows:

If to LICENSOR: Richard Disrud, COO
Aqua Innovations, Inc.
6101 Baker Rd., #206
Minnetonka, Minnesota 55435

If to LICENSEE: Jeffrey Brink, CEO
Oxygenator Water Technology, Inc.
6101 Baker Rd., #206
Minnetonka, Minnesota 55435

Either party may change its address by giving notice in writing, stating the new address, to the other Party as provided in the foregoing manner. Commencing on the tenth (10th) day after the giving of such notice, such newly designated address shall be such Party's address for the purpose of all communications, demands, notices or objections required or permitted to be given or served under this Agreement.

ARTICLE 7
MISCELLANEOUS

7.1. Governing Law; Court Proceedings. The validity, performance, and all matters relating to the interpretation and effect of this Agreement shall be governed by the internal law in effect in the State of Minnesota without regard to principles of law (such as "conflicts of law") that might make the law of some other jurisdiction applicable. Without limiting the terms set forth in Article 6 with respect to the resolution of disputes, each Party agrees to the exclusive and irrevocable jurisdiction of the federal and state courts of Minnesota for any claim, action or cause of action arising out of or in any way related to this Agreement which may be brought in a court of law and both parties agree that personal service from any such court may be effectively served upon a party at the respective addresses set forth in Section 7.1.

7.2. Exhibits. Exhibits, schedules and annexes referred to in this Agreement and attached hereto are incorporated herein in full by this reference as if each of such exhibits, schedules or annexes were set forth in the body of this Agreement and duly executed by the parties hereto.

7.3. Additional Documents and Acts. Each party agrees that it will use all reasonable efforts to take, or cause to be taken, all actions and to do, or cause to be done, all things necessary, proper or advisable, including, but not limited to, the execution of additional documents and instruments, to consummate, make effective and carry out the transactions contemplated by this Agreement.

7.4. Amendment, Modification or Waiver. No amendment, modification or waiver of any condition, provision or term of this Agreement shall be valid or of any effect unless made in writing, signed by the party or parties to be bound or its duly authorized representative and specifying with particularity the nature and extent of such amendment, modification or waiver. Any waiver by any party of a default of another party shall not affect or impair any right arising from any subsequent default.

7.5. Severable Provisions. Whenever possible, each provision of this Agreement will be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Agreement is held to be invalid, illegal or unenforceable under any applicable law or rule in any jurisdiction, such provision will be ineffective only to the extent of such invalidity, illegality, or unenforceability in such jurisdiction, without invalidating the remainder of this Agreement in such jurisdiction or any provision hereof in any other jurisdiction.

7.6. Entire Agreement. This Agreement contains the entire understanding of the parties hereto in respect of the transactions contemplated hereby and supersedes all prior agreements and understandings between the parties with respect to such subject matter.

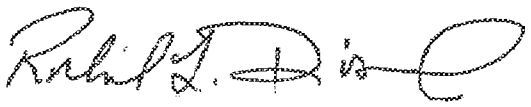
7.7. Captions, Headings, Titles or References to Gender. All captions, headings

or titles in the paragraphs or sections of this Agreement are inserted for convenience of reference only and shall not constitute a part of this Agreement or as a limitation of the scope of the particular paragraphs or sections to which they apply. Where appropriate, the masculine gender may be read as the feminine gender or the neuter gender, the feminine gender may be read as the masculine gender or the neuter gender and the neuter gender may be read as the masculine gender or the feminine gender.

7.8. Counterparts. This Agreement may be executed in two (2) or more counterparts, each of which shall be considered one and the same Agreement and shall become effective when one or more counterparts have been signed by each of the parties and delivered to the other parties.

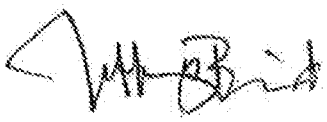
IN WITNESS WHEREOF, the parties have executed this Agreement on the date first written above.

AQUA INNOVATIONS, INC.



Dick Disrud its COO

OXYGENATOR WATER TECHNOLOGIES, INC.



Jeff Brink its CEO

EXHIBIT "A"

DESCRIPTION OF LICENSOR PATENTS AND PATENTS PENDING

United States Patent Number: US 6,689,262 B2
Date of Patent: February 10, 2004
Name: Microbubbles of Oxygen
Application Number: 10/372,017

An oxygen emitter which is an electrolytic cell. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The hydrogen forms bubbles at the cathode, which bubbles rise to the surface. The very small oxygen bubbles remain in suspension, forming a solution supersatured in oxygen.

United States Patent Number: US 7,396,441 B2
Publication Date: July 8, 2008
Name: Flow-Thru Oxygenator
Application Number: 10/732,326

An oxygen emitter which is an electrolytic cell. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The hydrogen forms bubbles at the cathode, which bubbles rise to the surface. The very small oxygen bubbles remain in suspension, forming a solution supersatured in oxygen. A flow-through model for oxygenating flowing water. The use of supersaturated water for enhancing the growth of plants. Method of applying supersaturated water to plants manually, by drip irrigation or in hydroponic culture. The treatment of waste water by raising the dissolved oxygen with the use of oxygen emitter.

Patent Application Information Retrieval

Order Certified Application As Filed | Order Certified File Wrapper | View Order List

12/023,431 FLOW-THROUGH OXYGENATOR

Select New Case | Application Data | Transaction History | Image File Wrapper | Patent Term Adjustments | Continuity Data | Fees | Published Documents | Address & Attorney/Agent

Bibliographic Data

Application Number:	12/023,431	Customer Number:	
Filing or 371 (c) Date:	01-31-2008	Status:	Patented Case
Application Type:	Utility	Status Date:	02-10-2010
Examiner Name:	ALLEN, CAMERON J	Location:	ELECTRONIC
Group Art Unit:	1797	Location Date:	
Confirmation Number:	7381	Earliest Publication No:	US 2008-0179259 A1
Attorney Docket Number:	4056.02US03	Earliest Publication Date:	07-31-2008
Class / Subclass:	210/748	Patent Number:	7,670,495
First Named Inventor:	James Andrew Senkiw , Minneapolis, MN (US)	Issue Date of Patent:	03-02-2010

Title of Invention: FLOW-THROUGH OXYGENATOR

If you need help:

- *Call the Patent Electronic Business Center at (866) 217-9197 (toll free) or e-mail EBC@uspto.gov for specific questions about Patent Application Information Retrieval (PAIR).*
- *Send general questions about USPTO programs to the USPTO Contact Center (UCC) .*
- *If you experience technical difficulties or problems with this application, please report them via e-mail to Electronic Business Support or call 1 800-786-9199.*

THIS PATENT ISSUED 3/2/2010. IN DISCUSSION WITH PAUL HANN, IT GIVES US BROAD COVERAGE.

United States Patent **7,670,495**
Senkiw **March 2, 2010**

Flow-through oxygenator

Abstract

An oxygen emitter which is an electrolytic cell is disclosed. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The very small oxygen bubbles remain in suspension, forming a solution supersaturated in oxygen. A flow-through model for oxygenating flowing water is disclosed. The use of supersaturated water for enhancing the growth of plants is disclosed. Methods for applying supersaturated water to plants manually, by drip irrigation or in hydroponic culture are described. The treatment of waste water by raising the dissolved oxygen with the use of an oxygen emitter is disclosed.

Inventors: **Senkiw; James Andrew** (Minneapolis, MN)
Assignee: **Oxygenator Water Technologies, Inc.** (Minnetonka, MN)
Appl. No.: **12/023,431**
Filed: **January 31, 2008**

Related U.S. Patent Documents

Application Number	Filing Date	Patent Number	Issue Date
10732326	Dec., 2003	7396441	
10372017	Feb., 2004	6689262	
60358534	Feb., 2002		

Current U.S. Class: 204/232; 204/245; 205/628; 210/243; 210/600
Current International Class: C02F 1/48 (20060101); C02F 1/00 (20060101); C25B 1/02 (20060101); C25B 1/04 (20060101)
Field of Search: 210/748,600,243 204/278,242,243,275.1,232,286.1,554,660 205/633-638

References Cited [Referenced By]

U.S. Patent Documents

4071447	January 1978	Ramirez
4225401	September 1980	Divisek et al.
4252856	February 1981	Sara
4257352	March 1981	Habegger
4587001	May 1986	Cairns et al.
5015354	May 1991	Nishiki et al.
5148772	September 1992	Kirschbaum
5534143	July 1996	Portier et al.
5982609	November 1999	Evans
6171469	January 2001	Hough et al.
6315886	November 2001	Zappi
6328875	December 2001	Zappi et al.
6394429	May 2002	Ganan-Calvo
6524475	February 2003	Herrington et al.
6689262	February 2004	Senkiw
7396441	July 2008	Senkiw
2002/0074237	June 2002	Takesako et al.
2003/0164306	September 2003	Senkiw
2004/0118701	June 2004	Senkiw
2006/0150491	July 2006	Senkiw
2008/0202995	August 2008	Senkiw

Foreign Patent Documents

0 723 936	Jul., 1996	EP
1 522 188	Aug., 1978	GB
WO 99/39561	Aug., 1999	WO
WO 01/89997	Nov., 2001	WO
WO 03/072507	Sep., 2003	WO

Other References

Mohyuddin Mirza et al., "Effect of Oxygenated Water on the Growth & Biomass Development of Seedless Cucumbers and Tomato Seedlings under Greenhouse Conditions," Seair Diffusion Systems, 2003, 5 pages, www.seair.ca. cited by other.

Primary Examiner: Griffin; Walter D
Assistant Examiner: Allen; Cameron J
Attorney, Agent or Firm: Patterson, Thuente, Skaar & Christensen, P.A.

Parent Case Text

RELATED APPLICATIONS

This application is a division of application Ser. No. 10/732,326 filed Dec. 10, 2003, which in turn is a continuation-in-part of application Ser. No. 10/372,017, filed Feb. 21, 2003, now U.S. Pat. No. 6,689,262, which claims the benefit of U.S. Provisional Application No. 60/358,534, filed Feb. 22, 2002, each of which is hereby fully incorporated herein by reference.

Claims

The invention claimed is:

1. A method for treating waste water comprising; providing a flow-through oxygenator comprising an emitter for electrolytic generation of microbubbles of oxygen comprising an anode separated at a critical distance from a cathode and a power source all in electrical communication with each other, placing the emitter within a conduit; and passing waste water through the conduit.

2. An emitter for electrolytic generation of microbubbles of oxygen in an aqueous medium comprising: an anode separated at a critical distance from a cathode, a nonconductive spacer maintaining the separation of the anode and cathode, the nonconductive spacer having a spacer thickness between 0.005 to 0.050 inches such that the critical distance is less than 0.060 inches and a power source all in electrical communication with each other, wherein the critical distance results in the formation of oxygen bubbles having a bubble diameter less than 0.0006 inches, said oxygen bubbles being incapable of breading the surface tension of the aqueous medium such that said aqueous medium is supersaturated with oxygen.

3. The emitter of claim 2, wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide.

4. The emitter of claim 2, wherein the anode is platinum and iridium oxide on a support.

5. The emitter of claim 2, wherein the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

6. The emitter of claim 2, wherein the critical distance is 0.005 to 0.060 inches.

7. The emitter of claim 2, comprising a plurality of anodes separated at the critical distance from a plurality of cathodes.

8. A method for oxygenating a non-native habitat for temporarily keeping aquatic animals, comprising: inserting the emitter of claim 2 into the aqueous medium, the non-native habitat comprising an aquarium, a bait bucket or a live well.

9. A method for lowering the biologic oxygen demand of polluted water comprising: passing the polluted water through a vessel containing the emitter of claim 2.

10. A supersaturated aqueous product formed with the emitter of claim 2, the supersaturated aqueous product having an approximately neutral pH.

11. The emitter of claim 2, further comprising a timer control.

12. The emitter of claim 2, wherein the anode and cathode are arranged such that the emitter assumes a funnel or pyramidal shaped emitter.

Description

FIELD OF THE INVENTION

This invention relates to the electrolytic generation of microbubbles of oxygen for increasing the oxygen content of flowing water. This invention also relates to the use of superoxygenated water to enhance the growth and yield of plants. The flow-through model is useful for oxygenating water for hydroponic plant culture, drip irrigation and waste water treatment.

BACKGROUND OF THE INVENTION

Many benefits may be obtained through raising the oxygen content of aqueous media. Efforts have been made to achieve higher saturated or supersaturated oxygen levels for applications such as the improvement of water quality in ponds, lakes, marshes and reservoirs, the detoxification of contaminated water, culture of fish, shrimp and other aquatic animals, biological culture and hydroponic culture. For example, fish held in a limited environment such as an aquarium, a bait bucket or a live hold tank may quickly use up the dissolved oxygen in the course of normal respiration and are then subject to hypoxic stress, which can lead to death. A similar effect is seen in cell cultures, where the respiring cells would benefit from higher oxygen content of the medium. Organic pollutants from agricultural, municipal and industrial facilities spread through the ground and surface water and adversely affect life forms. Many pollutants are toxic, carcinogenic or mutagenic. Decomposition of these pollutants is facilitated by oxygen, both by direct chemical detoxifying reactions or by stimulating the growth of detoxifying microflora. Contaminated water is described as having an increased biological oxygen demand (BOD) and water treatment is aimed at decreasing the BOD so as to make more oxygen available for fish and other life forms.

The most common method of increasing the oxygen content of a medium is by sparging with air or oxygen. While this is a simple method, the resulting large bubbles produced simply break the surface and are discharged into the atmosphere. Attempts have been made to reduce the size of the bubbles in order to facilitate oxygen transfer by increasing the total surface area of the oxygen bubbles. U.S. Pat. No. 5,534,143 discloses a microbubble generator that achieves a bubble size of about 0.10 millimeters to about 3 millimeters in diameter. U.S. Pat. No. 6,394,429 ("the '429 patent") discloses a device for producing microbubbles, ranging in size from 0.1 to 100 microns in diameter, by forcing air into the fluid at high pressure through a small orifice.

When the object of generating bubbles is to oxygenate the water, either air, with an oxygen content of about 21%, or pure oxygen may be used. The production of oxygen and hydrogen by the electrolysis of water is well known. A current is applied across an anode and a cathode which are immersed in an aqueous medium. The current may be a direct current from a battery or an AC/DC converter from a line. Hydrogen gas is produced at the cathode and oxygen gas is produced at the anode. The reactions are:

TABLE-US-00001 AT THE CATHODE: 4H.sub.2O + 4e.sup.- .fwdarw. 4OH.sup.- + 2H.sub.2 AT THE ANODE: 2H.sub.2O .fwdarw. O.sub.2 + 4H.sup.+ + 4e.sup.- NET REACTION: 6H.sub.2O .fwdarw. 4OH.sup.- + 4H.sup.+ ++ 2H.sub.2 + O.sub.2

286 kilojoules of energy is required to generate one mole of oxygen.

The gasses form bubbles which rise to the surface of the fluid and may be collected. Either the oxygen or the hydrogen may be collected for various uses. The "electrolytic water" surrounding the anode becomes acidic while the electrolytic water surrounding the cathode becomes basic. Therefore, the electrodes tend to foul or pit and have a limited life in these corrosive environments.

Many cathodes and anodes are commercially available. U.S. Pat. No. 5,982,609 discloses cathodes comprising a metal or metallic oxide of at least one metal selected from the group consisting of ruthenium, iridium, nickel, iron, rhodium, rhenium, cobalt, tungsten, manganese, tantalum, molybdenum, lead, titanium, platinum, palladium and osmium. Anodes are formed from the same metallic oxides or metals as cathodes. Electrodes may also be formed from alloys of the above metals or metals and oxides co-deposited on a substrate. The cathode and anodes may be formed on any convenient support in any desired shape or size. It is possible to use the same materials or different materials for both electrodes. The choice is determined according to the uses. Platinum and iron alloys ("stainless steel") are often preferred materials due to their inherent resistance to the corrosive electrolytic water. An especially preferred anode disclosed in U.S. Pat. No. 4,252,856 comprises vacuum deposited iridium oxide.

Holding vessels for live animals generally have a high population of animals which use up the available oxygen rapidly. Pumps to supply oxygen have high power requirements and the noise and bubbling may further stress the animals. The available electrolytic generators likewise have high power requirements and additionally run at high voltages and produce acidic and basic water which are detrimental to live animals. Many of the uses of oxygenators, such as keeping bait or caught fish alive, would benefit from portable devices that did not require a source of high power. The need remains for quiet, portable, low voltage means to oxygenate water.

It has also been known that plant roots are healthier when oxygenated water is applied. It is thought that oxygen inhibits the growth of deleterious fungi. The water sparged with air as in the '429 patent was shown to increase the biomass of hydroponically grown cucumbers and tomatoes by about 15%.

The need remains for oxygenator models suitable to be placed in-line in water distribution devices so as to be applied to field as well as hydroponic culture.

SUMMARY OF THE INVENTION

This invention provides an oxygen emitter which is an electrolytic cell which generates very small microbubbles and nanobubbles of oxygen in an aqueous medium, which bubbles are too small to break the surface tension of the medium, resulting in a medium supersaturated with oxygen.

The electrodes may be a metal or oxide of at least one metal selected from the group consisting of ruthenium, iridium, nickel, iron, rhodium, rhenium, cobalt, tungsten, manganese, tantalum, molybdenum, lead, titanium, platinum, palladium and osmium or oxides thereof. The electrodes may be formed into open grids or may be closed surfaces. The most preferred cathode is a stainless steel mesh. The most preferred mesh is a 1/16 inch grid. The most preferred anode is platinum and iridium oxide on a support. A preferred support is titanium.

In order to form microbubbles and nanobubbles, the anode and cathode are separated by a critical distance. The critical distance ranges from 0.005 inches to 0.140 inches. The preferred critical distance is from 0.045 to 0.060 inches.

Models of different size are provided to be applicable to various volumes of aqueous medium to be oxygenated. The public is directed to choose the applicable model based on volume and power requirements of projected use. Those models with low voltage requirements are especially suited to oxygenating water in which animals are to be held.

Controls are provided to regulate the current and timing of electrolysis.

A flow-through model is provided which may be connected in-line to a watering hose or to a hydroponic circulating system. The flow-through model can be formed into a tube with triangular cross-section. In this model, the anode is placed toward the outside of the tube and the cathode is placed on the inside, contacting the water flow. Alternatively, the anodes and cathodes may be in plates parallel to the long axis of the tube, or may be plates in a wafer stack. Alternately, the electrodes may be placed in a side tube ("T" model) out of the direct flow of water. Protocols are provided to produce superoxygenated water at the desired flow rate and at the desired power usage. Controls are inserted to activate electrolysis when water is flowing and deactivate electrolysis at rest.

This invention includes a method to promote growth and increase yield of plants by application of superoxygenated water. The water treated with the emitter of this invention is one example of superoxygenated water. Plants may be grown in hydroponic culture or in soil. The use of the flow-through model for drip irrigation of crops and waste water treatment is disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is the O.sub.2 emitter of the invention.

FIG. 2 is an assembled device.

FIG. 3 is a diagram of the electronic controls of the O.sub.2 emitter.

FIG. 4 shows a funnel or pyramid variation of the O.sub.2 emitter.

FIG. 5 shows a multilayer sandwich O.sub.2 emitter.

FIG. 6 shows the yield of tomato plants watered with superoxygenated water.

FIG. 7 shows an oxygenation chamber suitable for flow-through applications. FIG. 7A is a cross section showing arrangement of three plate electrodes. FIG. 7B is a longitudinal section showing the points of connection to the power source.

FIG. 8 is a graph showing the oxygenation of waste water.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

For the purpose of describing the present invention, the following terms have these meanings:

"Critical distance" means the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.

"Critical distance" means the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.

"O.sub.2 emitter" means a cell comprised of at least one anode and at least one cathode separated by the critical distance.

"Metal" means a metal or an alloy of one or more metals.

"Microbubble" means a bubble with a diameter less than 50 microns.

"Nanobubble" means a bubble with a diameter less than that necessary to break the surface tension of water. Nanobubbles remain suspended in the water, giving the water an opalescent or milky appearance.

"Supersaturated" means oxygen at a higher concentration than normal calculated oxygen solubility at a particular temperature and pressure.

"Superoxygenated water" means water with an oxygen content at least 120% of that calculated to be saturated at a temperature.

"Water" means any aqueous medium with resistance less than one ohm per square centimeter; that is, a medium that can support the electrolysis of water. In general, the lower limit of resistance for a medium that can support electrolysis is water containing more than 2000 ppm total dissolved solids.

The present invention produces microbubbles and nanobubbles of oxygen via the electrolysis of water. As molecular oxygen radical (atomic weight 8) is produced, it reacts to form molecular oxygen, O.sub.2. In the special dimensions of the invention, as explained in more detail in the following examples, O.sub.2 forms bubbles which are too small to break the surface tension of the fluid. These bubbles remain suspended indefinitely in the fluid and, when allowed to build up, make the fluid opalescent or milky. Only after several hours do the bubbles begin to coalesce on the sides of the container and the water clears. During that time, the water is supersaturated with oxygen. In contrast, the H.sub.2 formed readily coalesces into larger bubbles which are discharged into the atmosphere, as can be seen by bubble formation at the cathode.

The first objective of this invention was to make an oxygen emitter with low power demands, low voltage and low current for use with live animals. For that reason, a small button emitter was devised. The anode and cathode were set at varying distances. It was found that electrolysis took place at very short distances before arcing of the current occurred. Surprisingly, at slightly larger distances, the water became milky and no bubbles formed at the anode, while hydrogen continued to be bubbled off the cathode. At distance of 0.140 inches between the anode and cathode, it was observed that the oxygen formed bubbles at the anode. Therefore, the critical distance for microbubble and nanobubble formation was determined to be between 0.005 inches and 0.140 inches.

EXAMPLE 1

Oxygen Emitter

As shown in FIG. 1, the oxygen evolving anode 1 selected as the most efficient is an iridium oxide coated single sided sheet of platinum on a support of titanium (Eltech, Fairport Harbor, Ohio). The cathode 2 is a (fraction (1/16)} inch mesh (size 8 mesh) marine stainless steel screen. The anode and cathode are separated by a non-conducting spacer 3 containing a gap 4 for the passage of gas and mixing of anodic and cathodic water and connected to a power source through a connection point 5. FIG. 2

shows a plan view of the assembled device. The O.sub.2 emitter 6 with the anode connecting wire 7 and the cathode connecting wire 8 is contained in an enclosure 9, connected to the battery compartment 10. The spacer thickness is critical as it sets the critical distance. It must be of sufficient thickness to prevent arcing of the current, but thin enough to separate the electrodes by no more than 0.140 inches. Above that thickness, the power needs are higher and the oxygen bubbles formed at higher voltage will coalesce and escape the fluid. Preferably, the spacer is from 0.005 to 0.075 inches thick. At the lower limits, the emitter tends to foul more quickly. Most preferably, the spacer is about 0.050 inches thick. The spacer may be any nonconductive material such as nylon, fiberglass, Teflon.RTM., polymer or other plastic. Because of the criticality of the space distance, it is preferable to have a non-compressible spacer. It was found that Buna, with a durometer measure of 60 was not acceptable due to decomposition. Viton, a common fluoroelastomer, has a durometer measure of 90 and was found to hold its shape well.

In operation, a small device with an O.sub.2 emitter 1.485 inches in diameter was driven by 4AA batteries. The critical distance was held at 0.050 inches with a Viton spacer. Five gallons of water became saturated in seven minutes. This size is suitable for raising oxygen levels in an aquarium or bait bucket.

It is convenient to attach a control circuit which comprises a timer that is thermostatically controlled by a temperature sensor which determines the off time for the cathode. When the temperature of the solution changes, the resistance of the thermistor changes, which causes an off time of a certain duration. In cool water, the duration is longer so in a given volume, the emitter generates less oxygen. When the water is warmer and therefore hold less oxygen, the duration of off time is shorter. Thus the device is self-controlled to use power most economically. FIG. 3 shows a block diagram of a timer control with anode 1, cathode 2, thermistor temperature sensor 3, timer control circuit 4 and wire from a direct current power source 5.

EXAMPLE 2

Measurement of O.sub.2 Bubbles

Attempts were made to measure the diameter of the O.sub.2 bubbles emitted by the device of Example 1. In the case of particles other than gasses, measurements can easily be made by scanning electron microscopy, but gasses do not survive electron microscopy. Large bubble may be measured by pore exclusion, for example, which is also not feasible when measuring a gas bubble. A black and white digital, high contrast, backlit photograph of treated water with a millimeter scale reference was shot of water produced by the emitter of Example 1. About 125 bubbles were seen in the area selected for measurement. Seven bubbles ranging from the smallest clearly seen to the largest were measured. The area was enlarged, giving a scale multiplier of 0.029412.

Recorded bubble diameters at scale were 0.16, 0.22, 0.35, 0.51, 0.76, 0.88 and 1.09 millimeters. The last three were considered outliers by reverse analysis of variance and were assumed to be hydrogen bubbles. When multiplied by the scale multiplier, the assumed O.sub.2 bubbles were found to range from 4.7 to 15 microns in diameter. This test was limited by the resolution of the camera and smaller bubbles in the nanometer range could not be resolved. It is known that white light cannot resolve features in the nanometer size range, so monochromatic laser light may give resolution sensitive enough to measure smaller bubbles. Efforts continue to increase the sensitivity of measurement so that sub-micron diameter bubbles can be measured.

EXAMPLE 3

Other Models of Oxygen Emitter

Depending on the volume of fluid to be oxygenated, the oxygen emitter of this invention may be shaped as a circle, rectangle, cone or other model. One or more may be set in a substrate that may be metal, glass, plastic or other material. The substrate is not critical as long as the current is isolated to the electrodes by the nonconductor spacer material of a thickness from 0.005 to 0.075 inches, preferably 0.050 inches. It has been noticed that the flow of water seems to be at the periphery of the emitter, while the evolved visible bubbles (H.sub.2) arise at the center of the emitter. Therefore, a funnel or pyramidal shaped emitter was constructed to treat larger volumes of fluid. FIG. 4 is a cross sectional diagram of such an emitter. The anode 1 is formed as an open grid separated from a marine grade stainless steel screen cathode 2 by the critical distance by spacer 3 around the periphery of the emitter and at the apex. This flow-through embodiment is suitable for treating large volumes of water rapidly.

The size may be varied as required. A round emitter for oxygenating a bait bucket may be about 2 inches in diameter, while a 3-inch diameter emitter is adequate for oxygenating a 10 to 40 gallon tank. The live well of a fishing boat will generally hold 40 to 80 gallons of water and require a 4-inch diameter emitter. It is within the scope of this invention to construct larger emitters or to use several in a series to oxygenate larger volumes. It is also within the scope of this invention to vary the model to provide for low voltage and amperage in cases where the need for oxygen is moderate and long lasting or conversely, to supersaturate water very quickly at higher voltage and amperage. In the special dimensions of the present invention, it has been found that a 6 volt battery supplying a current as low as 40 milliamperes is sufficient to generate oxygen. Such a model is especially useful with live plants or animals, while it is more convenient for industrial use to use a higher voltage and current. Table I shows a number of models suitable to various uses.

TABLE-US-00002 TABLE I Emitter Model Gallons Volts Amps Max. Ave Watts Bait keeper 5 6 0.090 0.060 0.36 Livewell 32 12 0.180 0.120 1.44 OEM 2 inch 10 12 0.210 0.120 1.44 Bait store 70 12 0.180 0.180 2.16 Double cycle 2 12 0.180 0.180 2.16 OEM 3 inch 50 12 0.500 0.265 3.48 OEM 4 inch 80 12 0.980 0.410 4.92 Water pail 2 24 1.200 1.200 28.80 Plate 250 12 5.000 2.500 30.00

EXAMPLE 4

Multilayer Sandwich O.sub.2 Emitter

An O.sub.2 emitter was made in a multilayer sandwich embodiment. (FIG. 5) An iridium oxide coated platinum anode 1 was formed into a grid to allow good water flow and sandwiched between two stainless steel screen cathodes 2. Spacing was held at the critical distance by nylon spacers 3. The embodiment illustrated is held in a cassette 4 which is secured by nylon bolt 5 with a nylon washer 6. The dimensions selected were:

TABLE-US-00003 cathode screen 0.045 inches thick nylon spacer 0.053 inches thick anode grid 0.035 inches thick nylon spacer 0.053 inches thick cathode screen 0.045 inches thick,

for an overall emitter thickness of 0.231 inches thick inches.

If a more powerful emitter is desired, it is within the scope of this invention to repeat the sequence of stacking. For example, an embodiment may easily be constructed with this sequence: cathode, spacer, anode, spacer, cathode, spacer, anode, spacer, cathode, spacer, anode, spacer, cathode. The number of layers in the sandwich is limited only by the power requirements acceptable for an application.

EXAMPLE 5

Effect of Superoxygenated Water on the Growth of Plants

It is known that oxygen is important for the growth of plants. Although plants evolve oxygen during photosynthesis, they also have a requirement for oxygen for respiration. Oxygen is evolved in the leaves of the plants, while often the roots are in a hypoxic environment without enough oxygen to support optimum respiration, which can be reflected in less than optimum growth and nutrient utilization. Hydroponically grown plants are particularly susceptible to oxygen deficit in the root system. U.S. Pat. No. 5,887,383 describes a liquid supply pump unit for hydroponic cultures which attain oxygen enrichment by sparging with air. Such a method has high energy requirements and is noisy. Furthermore, while suitable for self-contained hydroponic culture, the apparatus is not usable for field irrigation. In a report available on the web, it was shown that hydroponically grown cucumbers and tomatoes supplied with water oxygenated with a device similar to that described in the '429 patent had increased biomass of about 12% and 17% respectively. It should be noted that when sparged with air, the water may become saturated with oxygen, but it is unlikely that the water is superoxygenated.

A. Superoxygenated Water in Hydroponic Culture.

Two small hydroponic systems were set up to grow two tomato plants. Circulation protocols were identical except that the 2 1/2 gallon water reservoir for the Control plant was eroated with and aquarium bubbler and that for the Test plant was oxygenated with a five-inch strip emitter for two minutes prior to pumping. The cycle was set at four minutes of pumping, followed by four minutes of rest. The control water had an oxygen content of about 97% to 103% saturation, that is, it was saturated with oxygen. The test water had an oxygen content of about 153% to 165% saturation, that is, it was supersaturated. The test plant was at least four times the volume of the control plant and began to show what looked like fertilizer burn. At that point the fertilizer for the Test plant was reduced by half. Since the plants were not exposed to natural light but to continuous artificial light in an indoor environment without the natural means of fertilization (wind and/or insects), the experiment was discontinued after three months. At that time, the Test plant but not the Control plant had blossomed.

B. Superoxygenated Water in Field Culture.

A pilot study was designed to ascertain that plants outside the hydroponic culture facility would benefit from the application of oxygen. It was decided to use water treated with the emitter of Example 1 as the oxygen carrier. Since water so treated is supersaturated, it is an excellent carrier of oxygen.

Tomato seeds (Burpee "Big Boy") were planted in one-inch diameter peat and dirt plugs encased in cheese cloth and placed in a tray in a southwest window. Controls were watered once a day with tap water ("Control") or oxygenated water ("Test"). Both Controls and Test sprouted at one week. After five weeks, the Test plants were an average of 11 inches tall while the Controls were an average of nine inches tall. At this time, May 10, when the threat of frost in Minnesota was minimal, the plants were transplanted to 13 inch diameter pots with drainage holes. Four inches of top soil was added to each pot, topped off with four inches of Scott's Potting Soil. The pots were placed outside in a sunny area with at least eight hours a day of full sun. The plants were watered as needed with either plain tap water (Control) or oxygenated water (Test). The oxygenated water was produced by use of the emitter of Example 1 run for one-half hour in a five-gallon container of water. Previous experiments showed that water thus treated had an oxygen content from 160% to 260% saturation. The Test plants flowered on June 4, while the Controls did not flower until June 18. For both groups, every plant in the group first had flowers on the same day. All plants were fertilized on July 2 and a soaker hose provided because the plants were now so big that watering by hand was difficult. The soaker hose was run for one half to one hour each morning, depending on the weather, to a point at which the soil was saturated with water. One

half hour after the soaker hose was turned off, about 750 ml of superoxygenated water was applied to each of the Test plants.

The Test plants were bushier than the Controls although the heights were similar. At this time, there were eight Control plants and seven Test plants because one of the Test plants broke in a storm. On July 2, the control plants averaged about 17 primary branches from the vine stem, while the control plants averaged about 13 primary branches from the vine stem. As the tomatoes matured, each was weighed on a kitchen scale at harvest. The yield history is shown in Table II.

TABLE-US-00004 TABLE II Control, grams Test, grams tomatoes from tomatoes from eight plants/ seven plants/ Week of: cumulative total cumulative total July 27 240 400 August 3 180 420 2910 3310 August 10 905 1325 1830 5140 August 17 410 1735 2590 7730 August 24 3300 5035 2470 10200 August 31 4150 9175 1580 11780 September 15 not weighed 3710 15490 Final Harvest 6435 15620 8895 24385 September 24

The total yield for the eight Control plants was 15620 grams or 1952 grams of tomatoes per plant.

The total yield for the seven Test plants was 24385 grams or 3484 grams of tomatoes per plant, an increase in yield of about 79% over the Control plants.

FIG. 6 shows the cumulative total as plotted against time. Not only did the Test plants blossom and bear fruit earlier, but that the Control plants never caught up to the test plants in the short Minnesota growing season. It should be noted that the experiment was terminated because of predicted frost. All fruits, both green and red, were harvested and weighed at that point.

EXAMPLE 6

Flow-Through Emitter for Agricultural Use

In order to apply the findings of example 5 to agricultural uses, an emitter than can oxygenate running water efficiently was developed. In FIG. 7(A), the oxygenation chamber is comprised of three anodes 1 and cathodes 2, of appropriate size to fit inside a tube or hose and separated by the critical distance are placed within a tube or hose 3 at 120.degree. angles to each other. The anodes and cathodes are positioned with stabilizing hardware 4. The stabilizing hardware, which can be any configuration such as a screw, rod or washer, is preferably formed from stainless steel. FIG. 7(B) shows a plan view of the oxygenation chamber with stabilizing hardware 4 serving as a connector to the power source and stabilizing hardware 5 serving as a connector to the power source. The active area is shown at 6.

This invention is not limited to the design selected for this embodiment. Those skilled in the art can readily fabricate any of the emitters shown in FIG. 4 or 5, or can design other embodiments that will oxygenate flowing water. One useful embodiment is the "T" model, wherein the emitter unit is set in a side arm. The emitted bubbles are swept into the water flow. The unit is detachable for easy servicing. Table III shows several models of flow through emitters. The voltage and flowrates were held constant and the current varied. The Dissolved oxygen (DO) from the source was 7.1 mg/liter. The starting temperature was 12.2.degree. C. but the flowing water cooled slightly to 11 or 11.5.degree. C. Without undue experimentation, anyone may easily select the embodiment that best suits desired characteristics from Table III or designed with the teachings of Table III.

TABLE-US-00005 TABLE III ACTIVE DO OF* ELECTRODE CURRENT, FLOW RATE SAMPLE AT MODEL AREA, SQ.IN. VOLTAGE AMPS. GAL/MINUTE ONE MINUTE 2-Inch "T" 2 28.3 0.72 12 N/A 3-inch "T" 3 28.3 1.75 12 N/A 2-plate Tube 20 28.3 9.1 12 8.4 3-Plate tube 30 28.3 12.8 12 9.6

*As the apparatus runs longer, the flowing water becomes milky, indicating supersaturation. The one-minute time point shows the rapid increase in oxygenation.

The following plants will be tested for response to superoxygenated water: grape vines, lettuce, and radishes in three different climate zones. The operators for these facilities will be supplied with units for drip irrigation. Drip irrigation is a technique wherein water is pumped through a pipe or hose with perforations at the site of each plant to be irrigated. The conduit may be underground or above ground. Since the water is applied directly to the plant rather than wetting the entire field, this technique is especially useful in arid climates or for plants requiring high fertilizer applications.

The superoxygenated water will be applied by drip irrigation per the usual protocol for the respective plants. Growth and yield will be compared to the same plants given only the usual irrigation water. Pest control and fertilization will be the same between test and control plants, except that the operators of the experiments will be cautioned to be aware of the possibility of fertilizer burn in the test plants and to adjust their protocols accordingly.

It is expected that the superoxygenated plants with drip irrigation will show more improved performance with more continuous application of oxygen than did the tomato plants of Example 5, which were given superoxygenated water only once a day.

EXAMPLE 7

Treatment of Waste Water

Waste water, with a high organic content, has a high BOD, due to the bacterial flora. It is desirable to raise the oxygen content of the waste water in order to cause the flora to flocculate. However, it is very difficult to effectively oxygenate such water. Using a 4 inch OEM (see Table I) with a 12 volt battery, four liters of waste water in a five gallon pail were oxygenated. As shown in FIG. 8, the dissolved oxygen went from 0.5 mg/l to 10.8 mg/l in nine minutes.

Those skilled in the art will readily comprehend that variations, modifications and additions may in the embodiments described herein may be made. Therefore, such variations, modifications and additions are within the scope of the appended claims.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	07/08/2008	7396441	4056.02US01	7020

24113 7590 06/18/2008

PATTERSON, THUENTE, SKAAR & CHRISTENSEN, P.A.
4800 IDS CENTER
80 SOUTH 8TH STREET
MINNEAPOLIS, MN 55402-2100

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 7 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

James Andrew Senkiw, Minneapolis, MN;

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24113 7590 04/23/2008

PATTERSON, THUENTE, SKAAR & CHRISTENSEN, P.A.
4800 IDS CENTER
80 SOUTH 8TH STREET
MINNEAPOLIS, MN 55402-2100

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	~~AQL.002US1~~ 4056.024501	7020

TITLE OF INVENTION: FLOW-THROUGH OXYGENATOR

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$720	$300	$0	$1020	07/23/2008

EXAMINER	ART UNIT	CLASS-SUBCLASS
ZHENG, LOIS L	1793	204-242000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Patterson, Thuente, Skaar & Christensen, P.A.
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Aqua Innovations, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Minnetonka, Minnesota

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☑ Issue Fee
☑ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies 10

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 16-0631 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature J. Paul Haun Date 5/21/08

Typed or printed name J. Paul Haun Registration No. 53,003

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	10732326
Filing Date:	10-Dec-2003
Title of Invention:	FLOW-THROUGH OXYGENATOR
First Named Inventor/Applicant Name:	James Andrew Senkiw
Filer:	J. Paul Haun/Valerie Mitchell
Attorney Docket Number:	4056.02US01

Filed as Small Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	2501	1	720	720
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
Printed copy of patent - no color	8001	10	3	30
		Total in USD ($)		**1050**

Electronic Acknowledgement Receipt

EFS ID:	3335034
Application Number:	10732326
International Application Number:	
Confirmation Number:	7020
Title of Invention:	FLOW-THROUGH OXYGENATOR
First Named Inventor/Applicant Name:	James Andrew Senkiw
Customer Number:	24113
Filer:	J. Paul Haun/Valerie Mitchell
Filer Authorized By:	J. Paul Haun
Attorney Docket Number:	4056.02US01
Receipt Date:	21-MAY-2008
Filing Date:	10-DEC-2003
Time Stamp:	11:55:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1050
RAM confirmation Number	6735
Deposit Account	160631
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	4056_02US01_ISSUE_FEE.pdf	74758 ff68917492b3e113534ee081d074c65bdce13e0c	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8433 17464757780f27cae4139989537ed2dfc81c6f28	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	83191		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

24113 7590 04/23/2008

PATTERSON, THUENTE, SKAAR & CHRISTENSEN, P.A.
4800 IDS CENTER
80 SOUTH 8TH STREET
MINNEAPOLIS, MN 55402-2100

EXAMINER	
ZHENG, LOIS L	
ART UNIT	PAPER NUMBER
1793	

DATE MAILED: 04/23/2008

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQL.002US1	7020

TITLE OF INVENTION: FLOW-THROUGH OXYGENATOR

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$720	$300	$0	$1020	07/23/2008

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24113 7590 04/23/2008

PATTERSON, THUENTE, SKAAR & CHRISTENSEN, P.A.
4800 IDS CENTER
80 SOUTH 8TH STREET
MINNEAPOLIS, MN 55402-2100

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQL.002US1	7020

TITLE OF INVENTION: FLOW-THROUGH OXYGENATOR

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$720	$300	$0	$1020	07/23/2008

EXAMINER	ART UNIT	CLASS-SUBCLASS
ZHENG, LOIS L	1793	204-242000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQL.002US1	7020

24113 7590 04/23/2008

PATTERSON, THUENTE, SKAAR & CHRISTENSEN, P.A.
4800 IDS CENTER
80 SOUTH 8TH STREET
MINNEAPOLIS, MN 55402-2100

EXAMINER	
ZHENG, LOIS L	
ART UNIT	PAPER NUMBER
1793	

DATE MAILED: 04/23/2008

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 7 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 7 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	LOIS ZHENG	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment after final filed 3 March 2008*.

2. ☒ The allowed claim(s) is/are *1-4, 9, 13, 15 and 17-26*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 7/19/2004,2/18/08
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Roy King/SPE, 1793

DETAILED ACTION

Status of Claims

1. Claims 1 and 25-26 are amended in view of applicants response filed 3 March 2009. Claims 14 and 16 are canceled in view of applicant's response. Claims 5-8 and 10-12 remain withdrawn from consideration. Therefore, claims 1-4, 9, 13, 15 and 17-26 are currently under examination.

Specification

2. The amendments to specification are entered and recorded.

Drawing

3. The drawings were received on 3 March 2008. These drawings are acceptable.

Information Disclosure Statement

4. The information disclosure statement (IDS) submitted on 18 February 2008 was filed after the mailing date of the Final Rejection on 1 November 2007. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Status of Previous Rejections

5. All previous rejections are withdrawn in view of applicant's claim amendments filed 3 March 2008.

Allowance

6. Claims 1-4, 9, 13, 15 and 17-26 are allowed.

7. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not teach or fairly suggest, either alone or in

combination, the claimed flow through oxygenator comprising three matched sets of anodes and cathodes attached to stabilizing hardware in adjacent relation such that each matched set resides at a 120° angle to the adjacent matched sets.

8. This application is in condition for allowance except for the presence of claims 5-8 and 10-12 directed to invention non-elected without traverse. Accordingly, claims 5-8 and 10-12 have been cancelled.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LOIS ZHENG whose telephone number is (571)272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Roy King/
Supervisory Patent Examiner, Art Unit 1793

LLZ

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	LOIS ZHENG	1793	

Issue Classification	Application/Control No. 10/732,326	Applicant(s)/Patent under Reexamination SENKIW, JAMES ANDREW
	Examiner LOIS ZHENG	Art Unit 1793

ISSUE CLASSIFICATION

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
204	278	C	25	B	1	/02	C	02	F	1	/00
		C	25	B	1	/04					/

CROSS REFERENCES				
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
204	242	275.1	232	286.1
204	554	660		
205	633	742		
210	243	748		

/Lois L. Zheng/ (Assistant Examiner) (Date)	/Roy King/, SPE, 1793, 3/12/08 (Primary Examiner) (Date)	**Total Claims Allowed: 17**
(Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 / O.G. Print Fig.: 7A

☐ **Claims renumbered in the same order as presented by applicant** ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
4	4		34		64		94		124		154		184
	5		35		65		95		125		155		185
	6		36		66		96		126		156		186
	7		37		67		97		127		157		187
	8		38		68		98		128		158		188
5	9		39		69		99		129		159		189
	10		40		70		100		130		160		190
	11		41		71		101		131		161		191
	12		42		72		102		132		162		192
6	13		43		73		103		133		163		193
	14		44		74		104		134		164		194
7	15		45		75		105		135		165		195
	16		46		76		106		136		166		196
8	17		47		77		107		137		167		197
9	18		48		78		108		138		168		198
10	19		49		79		109		139		169		199
11	20		50		80		110		140		170		200
12	21		51		81		111		141		171		201
13	22		52		82		112		142		172		202
14	23		53		83		113		143		173		203
15	24		54		84		114		144		174		204
16	25		55		85		115		145		175		205
17	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination
10/732,326	SENKIW, JAMES ANDREW
Examiner	**Art Unit**
LOIS ZHENG	1793

SEARCHED			
Class	Subclass	Date	Examiner
204	232	3/10/2008	LLZ
204	242	3/10/2008	LLZ
204	275.1	3/10/2008	LLZ
204	278	3/10/2008	LLZ
204	286.1	3/10/2008	LLZ
204	554	3/10/2008	LLZ
204	660	3/10/2008	LLZ
205	633	3/10/2008	LLZ
205	742	3/10/2008	LLZ
210	243	3/10/2008	LLZ
210	748	3/10/2008	LLZ

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
204	**278**	**3/10/2008**	**LLZ**
205	633	3/10/2008	LLZ
210	243	3/10/2008	LLZ

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Inventorship search	3/12/2008	LLZ
Updated EAST search	3/10/2008	LLZ

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S40	1	(204/554-573,660-674).ccls. and (anode cathode electrode) with angle with "120"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 14:36
S41	1	(210/243,748).ccls. and (anode cathode electrode) with angle with "120"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 14:37
S42	4	(210/243,748).ccls. and (anode cathode electrode) with angle with degree	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 14:38
S43	3	(204/554-573,660-674).ccls. and (anode cathode electrode) with angle with degree	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 15:24
S44	7	"210".clas. and (anode cathode electrode) with angle with degree	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 15:25
S45	115	(204/554-573,660-674).ccls. and (anode cathode electrode) with degree	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 15:26
S47	174	S46 not S44	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 15:58

Exhibit 1008_0090

S46	181	"210".clas. and (anode cathode electrode) with degree	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/07 15:58
S53	0	("204" "205").clas. and (anode cathode electrode) with ". degree."	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 09:59
S52	0	"210".clas. and (anode cathode electrode) with ". degree."	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 09:59
S51	0	"210".clas. and (anode cathode electrode) with angle with ".degree."	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 09:59
S54	4479	("204" "205").clas. and (anode cathode electrode) with degree	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 10:00
S55	1537	("204" "205").clas. and (anode cathode electrode) with degree and (anode cathode electrode) with (conduit pipe cylinder channel)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 10:01
S57	1161	S55 not (temperature with degree degree near2 (C F))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 10:02
S56	1188	S55 not (temperature with degree)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/10 10:02

Exhibit 1008_0091

L1	2	"6689262".pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/12 18:13
L2	7	james near2 senkiw	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/12 18:14

3/12/08 6:53:06 PM
C:\Documents and Settings\lzheng\My Documents\EAST\Workspaces\10732326.wsp

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Attorney Docket No.: 4056.02US01

Senkiw Confirmation No.: 7020

Application No.: 10/732,326 Examiner: Lois L. Zheng

Filed: December 10, 2003 Group Art Unit: 1793

For: FLOW-THROUGH OXYGENATOR

AMENDMENT AFTER FINAL

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

In response to the Final Office Action of November 1, 2007, and in accordance with the automatic extension of time for response provided by 37 CFR § 1.136(a), amendment to the above-identified patent application is requested.

The present amendment comprises the following sections:

A. Amendments to the Specification

B. Amendments to the Claims

C. Amendments to the Drawings

D. Remarks

OK TO ENTER: /LZ/

Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 16-0631.

Substitute for form 1449/PTO				*Complete if Known*	
				Application Number	10/732,326
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Filing Date	December 10, 2003
(Use as many sheets as necessary)				First Named Inventor	Senkiw
				Art Unit	1793
				Examiner Name	Lois L. Zheng
Sheet	1	of	1	Attorney Docket Number	4056.02US01

U.S. PATENT DOCUMENTS

EXAMINER INITIAL*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T[6]
LZ		WO 99/39561	08-12-1999	Mazzei	
LZ		WO 03/072507 A1	09-04-2003	Senkiw	

EXAMINER SIGNATURE	/Lois. L Zheng/	DATE CONSIDERED	3/17/08

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08B (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete If Known	
Application Number	10/732,326
Filing Date	December 10, 2003
First Named Inventor	James Andrew Senkiw
Art Unit	
Examiner Name	
Attorney Docket Number	AQI.002US1

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Effect of Oxygenated Water on the Growth and Biomass Development of Seedless Cucumbers and Tomato Seedlings under Greenhouse Conditions: Mohyuddin Mirza et al. www.seair.ca 2003	

Examiner Signature		Date Considered	11/21/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Attorney Docket No.: 4056.02US01

Senkiw Confirmation No.: 7020

Application No.: 10/732,326 Examiner: Lois L. Zheng

Filed: December 10, 2003 Group Art Unit: 1793

For: FLOW-THROUGH OXYGENATOR

AMENDMENT AFTER FINAL

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

In response to the Final Office Action of November 1, 2007, and in accordance with the automatic extension of time for response provided by 37 CFR § 1.136(a), amendment to the above-identified patent application is requested.

The present amendment comprises the following sections:

A. Amendments to the Specification

B. Amendments to the Claims

C. Amendments to the Drawings

D. Remarks

Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 16-0631.

AMENDMENTS TO THE SPECIFICATION

In the Specification

Please substitute the following amended paragraph(s) and/or section(s) (deleted matter is shown by strikethrough and added matter is shown by underlining):

Page 5, lines 5-23,

DESCRIPTION OF THE DRAWINGS

FIG. 1A is a plan view of an [[the]] O_2 emitter of the invention.

FIG. 1B is a section view of the O_2 emitter of Figure 1A taken at line 1B-1B of FIG. 1A.

FIG. 2A is a plan view of an assembled O_2 emitting device.

FIG. 2B is a perspective view of the assembled 02 emitting device of FIG. 2A.

FIG. 3 is a diagram of the electronic controls of the O_2 emitter.

FIG. 4 shows a funnel or pyramid variation of the O_2 emitter.

FIG. 5 shows a multilayer sandwich O_2 emitter.

FIG. 6 shows the yield of tomato plants watered with superoxygenated water.

~~FIG. 7 shows an oxygenation chamber suitable for flow-through applications.~~

FIG. 7A is a cross section showing arrangement of three plate electrodes.

FIG. 7B is a longitudinal section showing the points of connection to the power source.

FIG. 8 is a graph showing the oxygenation of waste water.

Page 7, line 16 – page 8, line 2,

As shown in FIGS. 1A, 1B, 2A and 2B, the oxygen evolving anode 1 selected as the most efficient is an iridium oxide coated single sided sheet of platinum on a support of titanium (Eltech, Fairport Harbor, OH). The cathode 2 is a {fraction (1/16)} inch mesh (size 8 mesh) marine stainless steel screen. The anode and cathode are separated by a non-conducting spacer 3 containing a gap 4 for the passage of gas and mixing of anodic and cathodic water and connected to a power source through a connection point 5. FIG. 2A shows a plan view of the assembled device. The O.sub.2 emitter 6 with the anode connecting wire 7 and the cathode connecting wire 8 is contained in an enclosure 9, connected to the battery compartment 10. The spacer thickness is critical as it sets the critical distance. It must be of sufficient thickness to prevent arcing of the current, but thin enough to separate the electrodes by no more than 0.140 inches. Above that thickness, the power needs are higher and the oxygen bubbles formed at higher voltage will coalesce and escape the fluid. Preferably, the spacer is from 0.005 to 0.075 inches thick. At the lower limits, the emitter tends to foul more quickly. Most preferably, the spacer is about 0.050 inches thick. The spacer may be any nonconductive material such as nylon, fiberglass, Teflon.RTM. polymer or other plastic. Because of the criticality of the space distance, it is preferable to have a non-compressible spacer. It was found that Buna, with a durometer measure of 60 was not acceptable due to decomposition. Viton, a common fluoroelastomer, has a durometer measure of 90 and was found to hold its shape well.

AMENDMENTS TO THE CLAIMS

A detailed listing of all claims that are, or were, in the present application, irrespective of whether the claim(s) remains under examination in the application are presented below. The claims are presented in ascending order and each includes one status identifier. Those claims not cancelled or withdrawn but amended by the current amendment utilize the following notations for amendment: 1. deleted matter is shown by strikethrough for six or more characters and double brackets for five or less characters; and 2. added matter is shown by underlining.

1. (Currently Amended) A flow through oxygenator comprising:

a fluid conduit having a fluid inlet and a fluid outlet fluidly connected with a conduit lumen;

an oxygen emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, the oxygen emitter including ~~a plurality of~~ three matched sets of anodes and cathodes wherein the matched sets of anodes and cathodes are mounted to stabilizing hardware such that the oxygen emitter is positioned within the conduit lumen and each matched set resides at a 120° angle to the adjacent matched sets; and

a power source in electrical communication with the oxygen emitter.

2. (Previously Presented) The flow through oxygenator of claim 1, wherein each anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide and each cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

3. (Previously Presented) The flow through oxygenator of claim 1, wherein the anode and cathode within each matched set are separated by a spacer such to maintain a gap of 0.005 to 0.140 inches between the anode and cathode.

4. (Previously Presented) The flow through oxygenator of claim ~~1~~ 3, wherein the gap is 0.045 to 0.060 inches.

5. (Withdrawn) The product of claim 1 wherein the water is supersaturated with oxygen and of an approximately neutral pH.

6. (Withdrawn) A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

7. (Withdrawn) The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

8. (Withdrawn) A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

9. (Previously Presented) The flow through oxygenator of claim 1 wherein each anode is platinum and iridium oxide on a support and each cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

10. (Withdrawn) A method to increase the oxygen content of flowing water comprising passing flowing water through a conduit comprising the flow-through oxygenator of claim 1.

11. (Withdrawn) The method of claim 11 wherein the flowing water has a temperature of 1 to 40 degrees Celsius.

12. (Withdrawn) The method of claim 11 wherein the flowing water becomes supersaturated with oxygen.

13. (Previously Presented) The flow through oxygenator of claim 1, wherein the power source is electrically connected to the stabilizing hardware for powering the plurality of matched sets of anodes and cathodes.

14. Cancelled.

15. (Previously Presented) The flow through oxygenator of claim 1, wherein the plurality of matched sets of anodes and cathodes are attached to the stabilizing hardware with the anodes proximate a conduit wall and the cathodes proximate a conduit center.

16. Cancelled.

17. (Previously Presented) The flow through oxygenator of claim 1, wherein the plurality of matched sets of anodes and cathodes define plates positioned parallel to a flow axis of the conduit lumen.

18. (Previously Presented) The flow through oxygenator of claim 1, wherein each cathode comprises a mesh screen.

19. (Previously Presented) The flow through oxygenator of claim 1, further comprising:

a controller selectively operating the power source, such that the power source supplies power to the plurality of matched sets of anodes and cathodes when the aqueous medium is flowing through the conduit lumen and withholds power when the aqueous medium is not flowing through the conduit lumen.

20. (Previously Presented) The flow through oxygenator of claim 1, wherein the oxygen emitter is sized to generate oxygen sufficient to form a supersaturated aqueous medium.

21. (Previously Presented) The flow through oxygenator of claim 1, wherein the aqueous medium is water.

22. (Previously Presented) The flow through oxygenator of claim 21, wherein the oxygen emitter is sized to generate oxygen sufficient to form superoxygenated water.

23. (Previously Presented) The flow through oxygenator of claim 1, wherein the fluid conduit is a watering hose.

24. (Previously Presented) The flow through oxygenator of claim 1, wherein the fluid conduit is a hydroponic circulating system.

25. (Currently Amended) A flow through oxygenator comprising:

a watering hose having a hose lumen; and

an oxygen emitter operably mounted within the hose lumen, the oxygen emitter including three matched sets of anodes and cathodes mounted to stablilizing hardware such that each matched set resides at a 120° angle to the adjacent matched sets.

26. (Currently Amended) A flow through oxygenator comprising:

a hydroponic circulating system having a circulating lumen; and

an oxygen emitter operably mounted within the circulating lumen, the oxygen emitter including three matched sets of anodes and cathodes mounted to stablilizing hardware such that each matched set resides at a 120° angle to the adjacent matched sets..

AMENDMENTS TO THE DRAWINGS

Attachment: Qty. 3 Replacement Sheets

Replacement sheets to correct identified deficiencies Figures 6, 7 and 8 are submitted to correct said deficiencies.

REMARKS

Claims 1-4, 9 and 13-26 are pending. By this Amendment, claims 14 and 16 are cancelled and claims 1, 25 and 26 are amended. By way of the present amendments to independent claims 1, 25 and 26, Applicant has included the subject matter of former dependent claim 14, which was indicated as being allowable in the Final Office Action mailed November 1, 2007. No new matter is believed introduced by way of the present amendments.

Drawings

In the Final Office Action mailed November 1, 2007, the drawings were objected to based on a number of identified deficiencies. Applicant respectfully requests said objections be withdrawn.

In response to the objections regarding Figures 1A, 1B, 2A and 2B, Applicant has amended the specification to discuss all of the submitted Figures.

In response to the objections to Figure 6, Applicant submits a replacement Figure 6 removing the additional data points and more accurately representing the data points.

In response to the objection to Figures 7(A) and 7(B), Applicant submits a replacement sheet and amends the specification to overcome said deficiencies.

In response to the objection to Figure 8, Applicant submits replacement Figure 8 as described in the application. In reviewing the original filing submission, it appears that an incorrect Figure was erroneously supplied as Figure 8. Applicant respectfully asserts that replacement Figure 8 is described and inherently supported in the original specification such that new Figure 8 does not consititute new matter.

Applicant has respectfully cancelled claim 16 including the limitation of a side arm flow portion.

Priority

Applicant respectfully takes no position concerning the effective filing date of the present application.

Claim Rejections 35 USC 102

In the Final Office Action mailed November 1, 2007, claims 1-3, 13, 15 and 17-22 were rejected under 35 USC 102(b) as being anticipated by U.S. Patent Publication No. 2002/0074237 A1 to Takesako. In the Final Office Action mailed November 1, 2007, claims 1-2, 13, 17 and 20-22 were rejected under 35 USC 102(b) as being anticipated by U.S. Patent No. 6,171,469 to Hough. By way of the present amendment to independent claim 1, Applicant has incorporated the previously indicated allowable subject matter of former dependent claim 14. As such, Applicant respectfully requests said rejections be withdrawn.

Claim Rejections 35 USC 103

In the Final Office Action mailed November 1, 2007, claims 4, 16 and 23-26 were rejected under 35 USC 103(a) as being unpatentable over Takesako. In the Final Office Action mailed November 1, 2007, claim 9 was rejected under 35 USC 103(a) as being unpatentable over Takesako in view of U.S. Patent No. 4,587,001 to Cairns et al. In the Final Office Action mailed November 1, 2007, claims 3-4, 16, 18-19 and 23-26 were rejected under 35 USC 103(a) as being unpatentable over Hough, and further in view of Takesako. In the Final Office Action mailed November 1, 2007, claim 9 was rejected under 35 USC 103(a) as being unpatentable over Hough, in view of Cairns. By way of the present amendment to independent claims 1, 25 and 26, Applicant has incorporated the previously indicated allowable subject matter of former dependent claim 14. As such, Applicant respectfully requests said rejections be withdrawn.

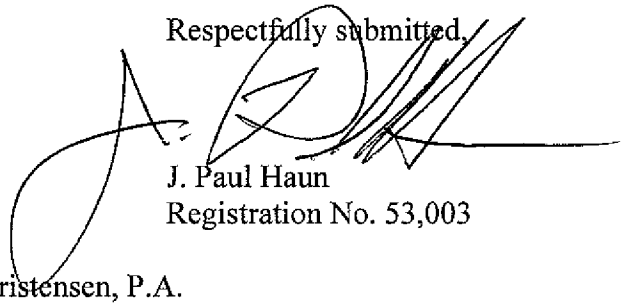
Double Patenting

In the Final Office Action mailed November 1, 2007, claims 1-4, 9, 13, 15 and 18-22 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 6, 9 and 13-14 of U.S. Patent No. 6,689,262 in view of Takesako. By way of the present amendment to independent claim 1, Applicant has incorporated the previously indicated allowable subject matter of former dependent claim 14. As such, Applicant respectfully requests said rejections be withdrawn.

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,



J. Paul Haun
Registration No. 53,003

Customer No. 24113
Patterson, Thuente, Skaar & Christensen, P.A.
4800 IDS Center
80 South 8th Street
Minneapolis, Minnesota 55402-2100
Telephone: (612) 349-3009

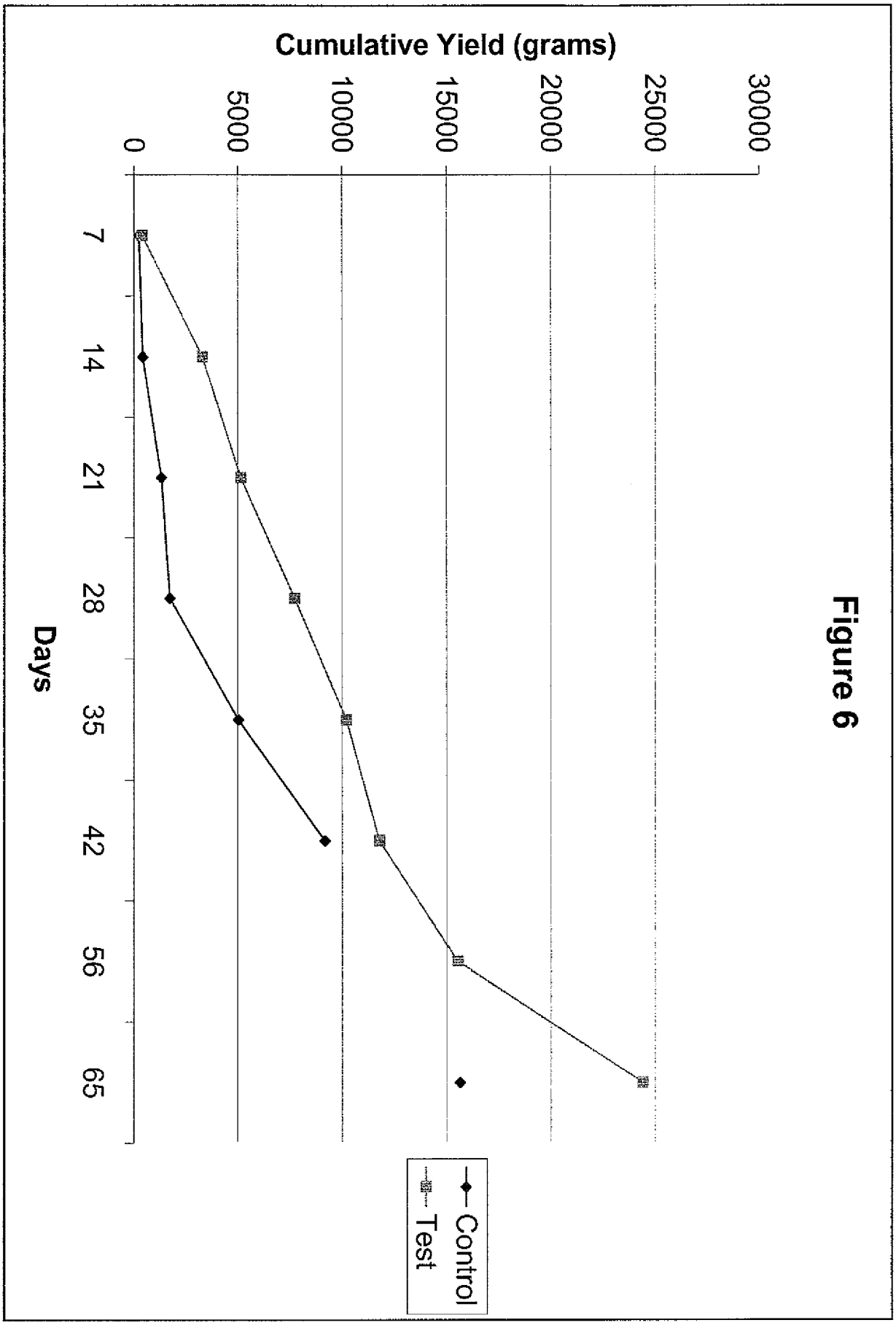
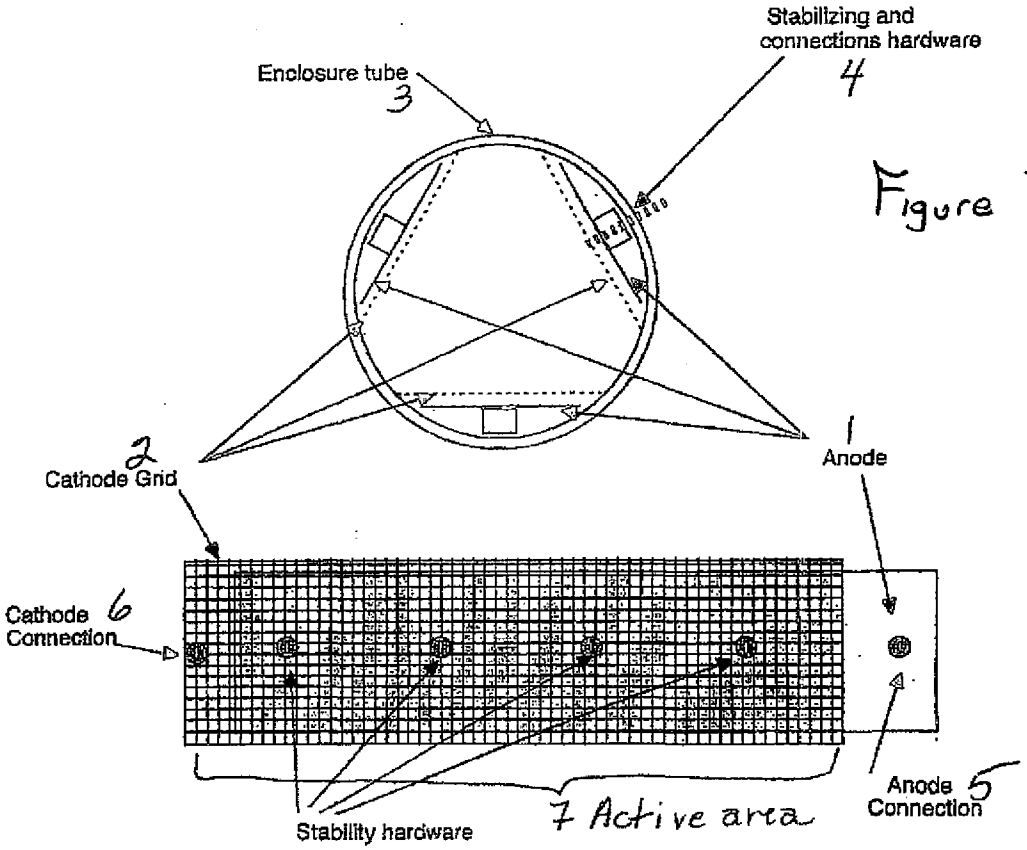

Cumulative Yield (grams)
0
5000
10000
15000
20000
25000
30000
Days
7
14
21
28
35
42
56
65
Control
Test

Figure 6

3 Element Flow Through Oxygenation Chamber



Depending on requirements tube can contain 1 2 3 4 or more elements.

Figure 7B

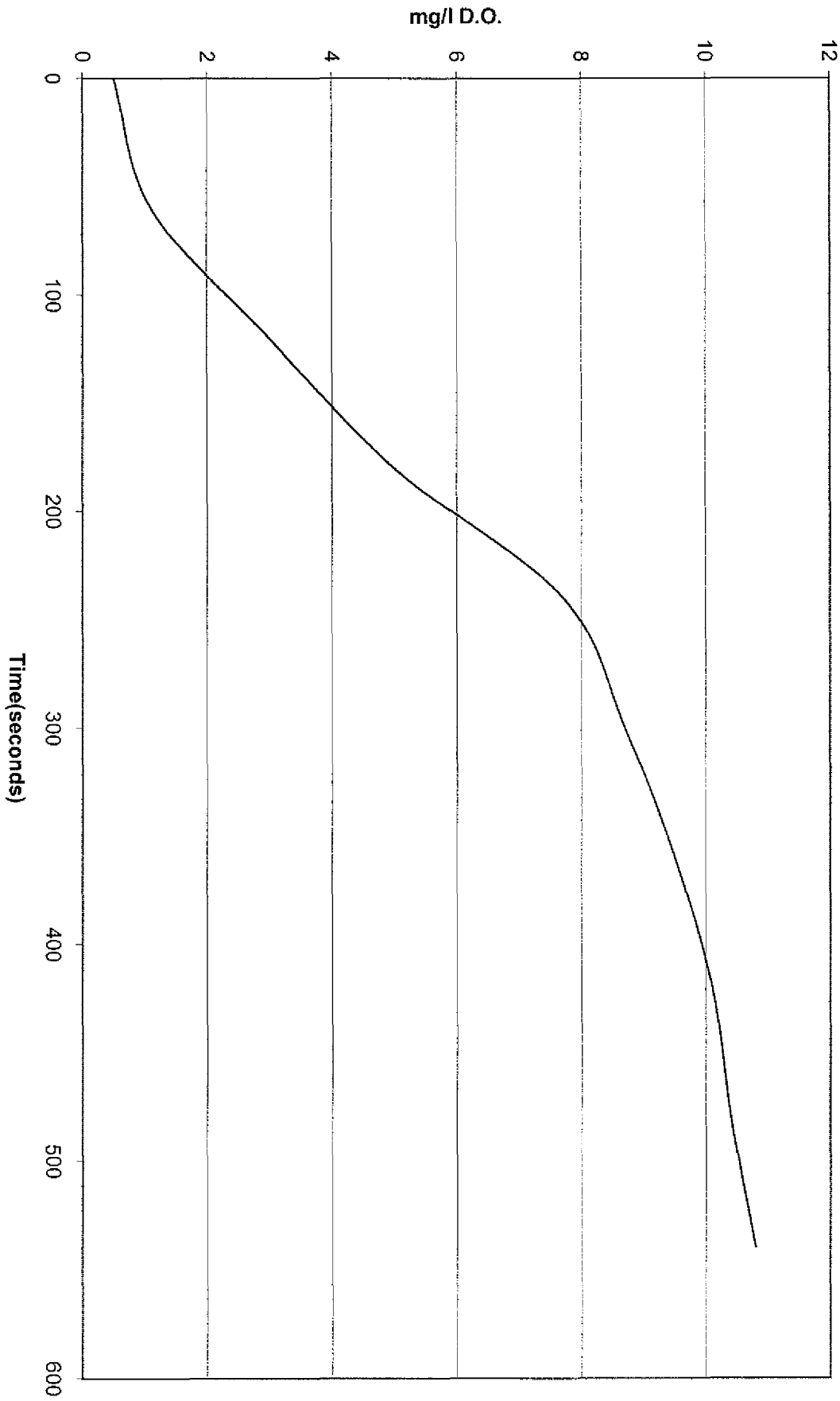


Fig. 8 Time vs D.O.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Attorney Docket No.: 4056.02US01

Senkiw Confirmation No.: 7020

Application No.: 10/732,326 Examiner: Lois L. Zheng

Filed: December 10, 2003 Group Art Unit: 1793

For: FLOW-THROUGH OXYGENATOR

PETITION FOR EXTENSION OF PERIOD FOR RESPONSE
UNDER 37 CFR § 1.136(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 CFR § 1.136(a), an extension of time of one (1) month (from February 1, 2008 to March 3, 2008, March 1, 2008 falling on a Saturday) within which to respond to the Office Action dated November 1, 2007 is requested. Please charge the $60.00 one month extension fee to Deposit Account No. 16-0631. Applicant is entitled to small entity status in accordance with 37 CFR 1.27. The Commissioner is authorized to charge to Deposit Account No. 16-0631 any underpayments, overpayments or additionally required fees.

Respectfully submitted,

J. Raul Haun
Registration No. 53,003

Customer No. 24113
Patterson, Thuente, Skaar & Christensen, P.A.
4800 IDS Center
80 South 8th Street
Minneapolis, Minnesota 55402-2100
Telephone: (612) 394-3009

Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 16-0631.

Electronic Patent Application Fee Transmittal

Application Number:	10732326
Filing Date:	10-Dec-2003
Title of Invention:	Flow-through oxygenator
First Named Inventor/Applicant Name:	James Andrew Senkiw
Filer:	J. Paul Haun/Allison Goette
Attorney Docket Number:	AQI.002US1

Filed as Small Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	60	60

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**60**

Electronic Acknowledgement Receipt

EFS ID:	2942752
Application Number:	10732326
International Application Number:	
Confirmation Number:	7020
Title of Invention:	Flow-through oxygenator
First Named Inventor/Applicant Name:	James Andrew Senkiw
Customer Number:	24113
Filer:	J. Paul Haun
Filer Authorized By:	
Attorney Docket Number:	AQI.002US1
Receipt Date:	03-MAR-2008
Filing Date:	10-DEC-2003
Time Stamp:	18:03:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$60
RAM confirmation Number	3074
Deposit Account	160631
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)

1		Amend_4056_02_01.pdf	256283 338bb813bcb33781529cbc9ade2d38d0eb18533d	yes	12

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment After Final	1	1
Specification	2	3
Claims	4	8
Applicant Arguments/Remarks Made in an Amendment	9	12

Warnings:					
Information:					
2	Drawings-only black and white line drawings	Drawings_4056_02_01.pdf	51529 bb221d1b1921ce46c69899bca34ec06c74b0aa14	no	3
Warnings:					
Information:					
3	Extension of Time	EOT_4056_02_01.pdf	28825 a6ffa5c2eff9989bd931eb7a0c17aaa1dccc7524	no	1
Warnings:					
Information:					
4	Fee Worksheet (PTO-06)	fee-info.pdf	8132 df91678d8b7cb9deb473971f5781deb27f62f847	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	344769		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/732,326	Filing Date 12/10/2003	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	03/03/2008	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 24	Minus	** 26	= 0	X $25 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $105 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)					
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/CRYSTAL QUEEN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Attorney Docket No.: 4056.02US01

Senkiw Confirmation No.: 7020

Application No.: 10/732,326 Examiner: Lois L. Zheng

Filed: December 10, 2003 Group Art Unit: 1793

For: FLOW-THROUGH OXYGENATOR

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 CFR § 1.56, and in addition to information disclosed in Applicant's Information Disclosure Statement filed July 19, 2004, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached Form PTO-1449. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom. The listing of a reference herein is not an admission that the reference is prior art or that the reference is material to patentability.

This Information Disclosure Statement is being filed more than three months after the U.S. filing date and after the mailing date of a Final Action, Notice of Allowance or an action that otherwise closes prosecution in the application but before payment of the Issue Fee. Applicant hereby petitions that the Information Disclosure Statement be considered. Please

charge the $180.00 petition fee under 37 CFR § 1.17(p) to Deposit Account No. 16-6031. Please credit or debit Deposit Account No. 16-0631 as needed to ensure consideration of the disclosed information.

I hereby certify that each item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. 37 CFR § 1.97(e)(1). A copy of the European Search Report is enclosed for the Examiner's convenience.

Respectfully submitted,

J. Paul Haun
Registration No. 53,003

Customer No. 24113
Patterson, Thuente, Skaar & Christensen, P.A.
4800 IDS Center
80 South 8th Street
Minneapolis, Minnesota 55402-2100
Telephone: (612) 349-3009

Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 16-0631.

Substitute for form 1449/PTO				Complete if Known	
				Application Number	10/732,326
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Filing Date	December 10, 2003
(Use as many sheets as necessary)				First Named Inventor	Senkiw
				Art Unit	1793
				Examiner Name	Lois L. Zheng
Sheet	1	of	1	Attorney Docket Number	4056.02US01

U.S. PATENT DOCUMENTS

EXAMINER INITIAL*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		
		US-		

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T[6]
		WO 99/39561	08-12-1999	Mazzei	
		WO 03/072507 A1	09-04-2003	Senkiw	

EXAMINER SIGNATURE		DATE CONSIDERED	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

Electronic Patent Application Fee Transmittal

Application Number:	10732326
Filing Date:	10-Dec-2003
Title of Invention:	Flow-through oxygenator
First Named Inventor/Applicant Name:	James Andrew Senkiw
Filer:	J. Paul Haun/Valerie Mitchell
Attorney Docket Number:	AQI.002US1

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	2873658
Application Number:	10732326
International Application Number:	
Confirmation Number:	7020
Title of Invention:	Flow-through oxygenator
First Named Inventor/Applicant Name:	James Andrew Senkiw
Customer Number:	24113
Filer:	J. Paul Haun/Valerie Mitchell
Filer Authorized By:	J. Paul Haun
Attorney Docket Number:	AQI.002US1
Receipt Date:	18-FEB-2008
Filing Date:	10-DEC-2003
Time Stamp:	16:06:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	7413
Deposit Account	160631
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed	4056_02US01_IDS.pdf	654682 d9c9b81d28e51d091b3c232ca22e60e5d0c68b26	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	4056_02US01_EPSEARCH.pdf	755715 35d60ba736afce768adfdacfce0aafff47062df0	no	3
Warnings:					
Information:					
3	Foreign Reference	4056_02_WO09939561A1.pdf	861803 fe50a0449e0b0c9051fa8d6a69e9f543117f5a86	no	21
Warnings:					
Information:					
4	Foreign Reference	4056_02_WO03072507A1.pdf	770577 b688350ba6f340216d46e4f90f431842f9cc8dcb	no	20
Warnings:					
Information:					
5	Fee Worksheet (PTO-06)	fee-info.pdf	8158 25337a4571f14dbf510e675b4323bf157ae605a0	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3050935		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQI.002US1	7020

24113 7590 11/01/2007

PATTERSON, THUENTE, SKAAR & CHRISTENSEN, P.A.
4800 IDS CENTER
80 SOUTH 8TH STREET
MINNEAPOLIS, MN 55402-2100

EXAMINER	
ZHENG, LOIS L	

ART UNIT	PAPER NUMBER
1793	

MAIL DATE	DELIVERY MODE
11/01/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	Lois Zheng	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 August 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) *5-8 and 10-12* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,9,13 and 15-26* is/are rejected.

7)☒ Claim(s) *14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1-4 and 9 are amended in view of applicant's amendment filed 17 August 2007. New claims 13-26 are added in view of applicant's amendment. Claims 5-8 and 10-12 remain withdrawn from consideration. Therefore, claims 1-4, 9 and 13-26 are currently under examination.

Status of Previous Rejections/Objections

2. The rejection of claims 1-3 under 35 U.S.C. 102(e) as being anticipated by Zappi et al. US 6,328,875 B1(Zappi) is withdrawn in view of applicant's claim amendment filed 17 August 2007.

The rejection of claim 4 under 35 U.S.C. 103(a) as being unpatentable over Zappi is withdrawn in view of applicant's claim amendment filed 17 August 2007.

The rejection of claim 9 under 35 U.S.C. 103(a) as being unpatentable over Zappi in view of Cairns et al. US 4,587,001(Cairns) is withdrawn in view of applicant's claim amendment filed 17 August 2007.

3. The rejection of claims 1-4 under 35 U.S.C. 103(a) as being unpatentable over Divisek et al. US 4,225,401(Divisek) is withdrawn in view of applicant's claim amendment filed 17 August 2007.

The rejection of claim 9 under 35 U.S.C. 103(a) as being unpatentable over Divisek in view of Cairns et al. US 4,587,001(Cairns) is withdrawn in view of applicant's claim amendment filed 17 August 2007.

Drawings

4. The drawings are objected to because:

Fig. 1A, 1B, 2A, 2B are shown in the drawings. However, the specification only discusses Fig. 1 and Fig. 2 as a whole.

Fig. 6 shows two additional data points for "control" data set on August 10 and 17 above the "Test" data set. These data points are not discussed in the specification. In addition, the date increments on the x-axis are not proportionally and accurately represented.

Figs. 7(A) and 7(B) as discussed on lines 24 and 29 on page 13 of the specification are not properly labeled in Fig. 7.

On page 15, lines 15-20 of the instant specification teaches that Fig. 8 shows dissolved oxygen went from 0.5mg/l to 10.8 mg/l in nine minutes. However, Fig. 8 does not show dissolved oxygen levels over time. Instead, it shows temperature variation over time.

The claimed feature of a side arm flow portion, wherein the oxygen emitter reside, is not shown in any of the figures.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet,

and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Priority

5. This application is a CIP of previously filed US patent application 10/372,017, now Patent No. 6,689,262. However, the parent patent does not disclose the claimed stabilizing hardware, the claimed water hose and the claimed hydroponic circulating system as recited in independent claims 1 and 25-26. Therefore, the instant application does NOT benefit from the effective filing date of the parent patent. The effective filing date of the current application is 10 December 2003.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-3, 13, 15 and 17-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Takesako et al. US 2002/0074237 A1(Takesako).

Takesako teaches a water electrolyzer comprising a fluid conduit having a fluid inlet and a fluid outlet connected with a conduit lumen(Fig. 1(a)-(b), #1, 21, 22). Takesako also teaches an electrolysis cell positioned within the conduit lumen and parallel to a flow axis of the conduit lumen(Fig. 1(b), paragraph [0021]). The electrolysis cell as taught by Takesako comprises a plurality of matched sets of anodes and cathodes and secured to electrode connecting rods by conductive bolts and spacers(Figs. 2-3, #2, 4, 25-27 and 31-33, paragraph [0056]). In addition, the electrodes are expanded metal mesh(paragraphs [0012, 0062] and the distance between the electrodes does not exceed 3.0mm(paragraph [0017]). Takesako further teaches that the electrolysis cell in the conduit lumen is connected to a power source (Fig. 1(b)).

Regarding claims 1-3, 17-18 and 21, the water electrolyzer as taught by Takesako reads on the claimed flow through oxygenator. The electrolysis cell within the conduit lumen as taught by Takesako reads on the claimed oxygen emitter. The electrode connecting rods, the conductive bolts and the conductive spacers that secure the plurality of matched sets of electrodes as taught by Takesako reads on the claimed stabilizing hardware.

Regarding claim 13, based on the shape of the electrode connecting rods and the way the electrodes are structured and secured, the examiner takes a position that the power source in the apparatus of Takesako is inherently connected to the electrode connecting rods, which is a part of the claimed stabilizing hardware, to provide electricity to the electrodes.

Regarding claim 15, Takesako further teaches that the polarity of the electrodes are reversed periodically(paragraphs [0011,0024, 0063-0065]). Therefore, the perforated electrodes proximate the conduit wall in the apparatus of Takesako function as anodes and the non-perforated electrodes proximate a conduit center in the apparatus of Takesako function as cathodes during periods of operation, which meets the limitation of the instant claim 15.

Regarding claim 19, Takesako further teaches a controller connected to a flow detecting circuit for controlling the voltage and the polarity applied to the water electrolysis cell(paragraphs [0063-0065]). Therefore, the controller as taught by Takesako is inherently capable of operating the power source in the claimed manner.

Regarding claims 20 and 22, since Takesako teaches a flow through water electrolyzer that is structurally the same as the claimed flow through oxygenator, the examiner takes a position that the apparatus of Takesako is capable of generating oxygen sufficient to form a supersaturated aqueous medium as claimed.

8. Claims 1-2, 13, 17 and 20-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Hough et al. US 6,171,469 B1(Hough).

Hough teaches a water electrolyzer for increasing oxygen content of water(abstract, title), wherein the water electrolyzer comprises a flow conduit having an inlet and an outlet connected to the conduit lumen(Fig. 1 #11-12). Hough also teaches a plurality of matched sets of anodes and cathodes mounted to stabilizing hardware and positioned within the conduit lumen(Fig. 2C). The electrodes are connected to a power source(Fig. 1 #14, col. 3 lines 6-11). The electrodes in the water electrolyzer of Hough

are metal(col. 3 lines 1-5) and are positioned parallel to the flow axis of the conduit(Fig. 2C).

Regarding claims, 1-2, 17 and 21, the water electrolyzer of Hough meets the structural limitations of the instant claims.

Regarding claim 13, based on the connection between the electrode plates and the stabilizing hardware, the examiner takes a position that the power source in the apparatus of Hough is inherently connected to the electrode connecting nuts and bolts and contacting wires(i.e. stabilizing hardware) to provide electricity to the electrodes.

Regarding claims 20 and 22, since Hough teaches a flow through water electrolyzer that is structurally the same as the claimed flow through oxygenator, the examiner takes a position that the apparatus of Hough is capable of generating oxygen sufficient to form a supersaturated aqueous medium as claimed.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 4, 16 and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takesako.

The teachings of Takesako are discussed in paragraph 7 above.

Regarding claim 4, the inter-electrode distance of not exceeding 3mm as taught by Takesako encompasses the claimed gap of 0.045-0.060 inches(i.e. 1.143-1.524

mm). Therefore, a prima facie case of obviousness exists. See MPEP 2144.05. The selection of claimed gap between electrodes from the disclosed gap of Takesako would have been obvious to one skilled in the art since Takesako teaches the same utilities in its disclosed inter-electrode distance.

Regarding claim 16, even though Takesako does not explicitly teach the claimed oxygen emitter positioned within a side arm flow portion of the conduit lumen, one of ordinary skill in the art would have found it obvious to have positioned the water electrolysis cell in any part of the conduit lumen, including the claimed side arm flow portion, with expected success since water flows through any part of the conduit lumen and the location of the electrolysis cell is an obvious variation absence any evidence that a specific location is superior.

Regarding claims 23-26, even though Takesako does not explicitly teach using the water electrolysis cell in the claimed watering hose or the claimed hydroponic circulating system, one of ordinary skill in the art would have found it obvious to have adapted the water electrolysis cell as taught by Takesako in any suitable applications wherein electrolyzed water is desirable, including the claimed watering hose and the claimed hydroponic circulating system.

11. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takesako, in view of Cairns et al. US 4,587,001(Cairns).

The teachings of Takesako are discussed in paragraphs 7 and 10 above.

However, Takesako does not explicitly teach the claimed anode being platinum and iridium oxide on a support.

Cairns teaches an cathode for use in an electrolytic cell(abstract). Cairns further teaches an titanium anode having a electro-catalytically active coating material comprising one or more oxides of platinum group metals such as platinum and iridium(col. 5 lines 15-25).

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the anode of Cairns into the water electrolysis cell of Takesako as the anode since Cairns teaches that platinum group metal oxides is a good electro-catalytically active material for an anode of an electrolytic cell and the application of such coating on an anode is well known in the art(col. 5 lines 15-16 and 32-33).

12. Claims 3-4, 16, 18-19 and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hough, and further in view of Takesako.

The teachings of Hough are discussed in paragraph 8 above. However, Hough does not explicitly teach the claimed inter-electrode distance, the claimed metal mesh electrode and the claimed controller.

The teachings of Takesako are discussed in paragraphs 7 and 10 above.

Regarding claims 3-4, it would have been obvious to one of ordinary skill in the art to have incorporated the inter-electrode distance of not exceeding 3mm as taught by Takesako into the water electrolyzer of Hough in order to receive an increased current without using a very high voltage as taught by Takesako. In addition, the inter-electrode as taught by Hough in view of Takesako encompasses the claimed gap of 0.045-0.060 inches(i.e. 1.143-1.524 mm). Therefore, a prima facie case of obviousness exists. See MPEP 2144.05. The selection of claimed gap between electrodes from the disclosed

gap of Hough in view of Takesako would have been obvious to one skilled in the art since Hough in view of Takesako teach the same utilities in their disclosed inter-electrode distance.

Regarding claim 16, even though Hough in view of Takesako do not explicitly teach the claimed oxygen emitter positioned within a side arm flow portion of the conduit lumen, one of ordinary skill in the art would have found it obvious to have positioned the water electrolysis cell in any part of the conduit lumen, including the claimed side arm flow portion, with expected success since water flows through any part of the conduit lumen and the location of the electrolysis cell is an obvious variation absence any evidence that a specific location is superior.

Regarding claim 18, Takesako further teaches that perforated electrode plates facilitate the flow of water into the flow passages between the electrode plates (paragraph 0062). Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the perforated electrode plates as taught by Takesako into the water electrolyzer of Hough in order to facilitate the flow of water into the flow passages as taught by Takesako.

Regarding claim 19, Takesako further teaches the use of a control circuit and a flow detecting circuit to control the voltage from the power source applied to the electrolyzer(paragraphs[0063-0065]). Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the control circuit and the flow detecting circuit as taught by Takesako into the water electrolyzer of Hough in order to control the voltage of the electrolyzer as taught by Takesako.

Regarding claims 23-26, even though Hough in view of Takesako do not explicitly teach using the water electrolysis cell in the claimed watering hose or the claimed hydroponic circulating system, one of ordinary skill in the art would have found it obvious to have adapted the water electrolyzer as taught by Hough in view of Takesako in any suitable applications wherein electrolyzed water is desirable, including the claimed watering hose and the claimed hydroponic circulating system.

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hough, in view of Cairns.

The teachings of Hough are discussed in paragraph 8 above.

However, Hough does not explicitly teach the claimed anode being platinum and iridium oxide on a support.

The teachings of Cairns are discussed in paragraph 11 above.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the anode of Cairns into the water electrolyzer of Hough as the anode since Cairns teaches that platinum group metal oxides is a good electro-catalytically active material for an anode of an electrolytic cell and the application of such coating on an anode is well known in the art(col. 5 lines 15-16 and 32-33).

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., In re Berg, 140

F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); In re Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); In re Longi, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); In re Van Ornum, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and In re Thorington, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

15. Claims 1-4, 9, 13, 15 and 18-22 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6, 9 and 13-14 of U.S. Patent No. 6,689,262 B2(US'262) in view of Takesako.

Claims of U.S. Patent No. 6,689,262 B2 teach an oxygen emitter that is structurally similar to the emitter of the claimed flow-through oxygenator.

However, claims of US'262 does not explicitly teach that the anodes and the cathodes are mounted to stabilizing hardware.

The teachings of Takesako are discussed in paragraph 7 above. Therefore, it would have been obvious to one of ordinary skill in the art to have adapted the electrode connecting rods, the conductive bolts and spacers(i.e. stabilizing hardware) as taught by Takesako into the oxygen emitter of US'262 in order to securely position the oxygen emitter within a flow conduit as taught by Takesako.

Allowable Subject Matter

16. Claim 14 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

17. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not teach or fairly suggest, either alone or in combination, the claimed flow through oxygenator comprising three matched sets of anodes and cathodes attached to stabilizing hardware in adjacent relation such that each matched set resides at a 120° angle to the adjacent matched sets.

Response to Arguments

18. Applicant's arguments filed 17 August 2007 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Nishiki et al. US 5,015,354 teaches a bi-polar water electrolyzer comprising a water electrolysis cell positioned within a flow conduit and secured by stabilizing hardware, wherein the electrodes are parallel to the flow axis.

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lois Zheng whose telephone number is (571) 272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LLZ

Notice of References Cited	Application/Control No. 10/732,326	Applicant(s)/Patent Under Reexamination SENKIW, JAMES ANDREW	
	Examiner Lois Zheng	Art Unit 1793	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,015,354	05-1991	Nishiki et al.	204/254
*	B	US-2002/0074237	06-2002	Takesako et al.	205/628
*	C	US-6,171,469	01-2001	Hough et al.	205/743
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
10/732,326	SENKIW, JAMES ANDREW	
Examiner	**Art Unit**	
Lois Zheng	1793	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Inventorship search	10/19/2007	LLZ
Updated EAST search	10/19/2007	LLZ

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S12	2	"5887383".pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 10:28
S11	1	10/732326	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 10:28
S1	12	("4252856"|"5534143"|"5982609"|"6315886"|"6394429"|"6689262"). PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:29
S13	2	"6689262".PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:30
S14	10	("3975269" | "4012319" | "4732661" | "4908109" | "5049252" | "5182014" | "5534143" | "6315886" | "6394429" | "6471873" | "WO 9521795").PN. OR ("6689262"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/10/19 11:33
S16	17869	(tube pipe conduit) with (cell unit electrolyzer) and ((anode same cathode) electrode) with (gap distance apart spac$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:36
S21	727	(tube pipe conduit) with oxygenat$3 with water	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:45
S20	180	(tube pipe conduit) with ((oxygen "O.sub.2") near3 emitt$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:45

EAST Search History

S29	3152	(tube pipe conduit hose cylind$5) with oxygen$5 and ("204" "205"). clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:47
S28	519	(tube pipe conduit hose cylind$5) with oxygen$5 with water and ("204" "205").clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:47
S27	27	(tube pipe conduit) with oxygenat$3 with water and ("204" "205").clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:47
S26	11	(S18 not S17) and ("204" "205"). clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:47
S25	0	(tube pipe conduit hose cylind$5) with oxygen$5 and ("204" "205"). ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:47
S30	27	S29 and (oxygenator superoxygen$4 super adj oxygen$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:49
S18	629	S15 and (oxygenator superoxygen$4 super adj oxygen$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:49
S15	435605	(tube pipe conduit) with (cell unit electrolyzer)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:55

EAST Search History

S31	1603	(tube pipe conduit) with (cell unit electrolyzer) and ("204" "205").clas. and parallel$3 with (anode cathode electrode)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 11:56
S33	12	("2829095" | "4252628" | "4402810" | "4413041" | "4734181" | "4755272").PN. OR ("5015354"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/10/19 16:52
S32	322	S31 and (generat$4 produc$4 mak$3) near3 (oxygen "O.sub.2")	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 17:07
S34	1603	(tube pipe conduit) with (cell unit electrolyzer) and ("204" "205").clas. and parallel$3 with (anode cathode electrode)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 17:08
S17	23	S16 and (oxygenator superoxygen$4 super adj oxygen$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 17:08
S35	3	S34 and (oxygenator superoxygen$4 super adj oxygen$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/19 17:09
S37	6478	flow adj through near2 (electrolyzer cell unit oxygenator) and (inch$2 mm millimeter)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/23 15:05
S36	17718	flow adj through near2 (electrolyzer cell unit oxygenator)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/23 15:05

EAST Search History

S38	592	flow adj through near2 (electrolyzer cell unit oxygenator) and (inch$2 mm millimeter) with (electrode anode cathode) and ("204" "205"). clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/10/23 15:10
S39	49	("2468357" | "2864750" | "3095365" | "3523891" | "3654119" | "3728245" | "3819504" | "3865710" | "3925176" | "3943044" | "4017375" | "4119517" | "4132620" | "4160716" | "4180445" | "4312736" | "4385973" | "4419206" | "4425216" | "4436601" | "4451341" | "4528083" | "4572775" | "4623436" | "4639303" | "4761208" | "4781805" | "4783246" | "4784735" | "4790914" | "4797182" | "4839007" | "4917782" | "4936979" | "5062940" | "5292412" | "5324398" | "5328584" | "5389214" | "5427667" | "5460702" | "5728287" | "6171469").PN. OR ("6478949"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/10/29 11:49

PATTERSON | THUENTE
SKAAR | CHRISTENSEN | IP

Patent, Trademark, Copyright, Internet & Related Laws | Patterson, Thuente, Skaar & Christensen, P.A.

4800 IDS Center
80 South 8th Street
Minneapolis, MN
55402-2100

t: 612.349.5740
t: 800.331.4537
f: 612.349.9266
www.ptslaw.com

FACSIMILE COVER SHEET

TOTAL NUMBER OF PAGES BEING SENT (INCLUDING COVER SHEET): 15

[ ] Original documents to follow by mail [X] No originals will be sent

DATE: August 17, 2007

TO: Examiner Lois L. Zheng
Group Art Unit 1742

FAX #: 571-273-8300

Application No.: 10/732,326 OUR REF.: 4056.02US01
Applicant: James Andrew Senkiw
Due Date: 8/24/07

FROM: J. Paul Haun
PHONE #: 612-349-3009

Attached please find the following for filing in the above-identified application:

1. Amendment in response to Office Action dated May 24, 2007 (10 pages);
2. Substitution of Attorney (2 pages); and
3. Certificate Under 37 CFR§3.73.(b) (2 pages).

Respectfully submitted,

J. Paul Haun
Registration No. 53,003

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being transmitted by facsimile to the U.S. Patent and Trademark Office, Fax No. 571-273-8300 on the date shown below.

8/17/87
Date

J. Paul Haun

THIS FACSIMILE TRANSMISSION CONTAINS LEGALLY PRIVILEGED AND CONFIDENTIAL INFORMATION INTENDED FOR THE PARTY IDENTIFIED ABOVE. IF YOU HAVE RECEIVED THIS TRANSMISSION IN ERROR, PLEASE CALL PATTERSON, THUENTE, SKAAR & CHRISTENSEN COLLECT AT (612) 349-5740. DISTRIBUTION, REPRODUCTION OR ANY OTHER USE OF THIS TRANSMISSION BY ANY PARTY OTHER THAN THE INTENDED RECIPIENT IS STRICTLY PROHIBITED.

FACSIMILE SENT BY DMW

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:		Attorney Docket No.: 4056.02US01
	James Andrew Senkiw	Confirmation No.: 7020
Application No.:	10/732,326	Examiner: Zheng, Lois L.
Filed:	December 10, 2003	Group Art Unit: 1742
For:	FLOW-THROUGH OXYGENATOR	

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

In response to the Office Action mailed May 24, 2007, amendment to the above-identified patent application is requested.

The present amendment comprises the following sections:

A. Amendments to the Claims

B. Remarks

Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 16-0631.

CERTIFICATE OF MAILING

I hereby certify that this document is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

8/17/07
Date of Deposit

J. Paul Haun

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A flow through oxygentaor ~~consisting of~~ comprising:

a fluid conduit having a fluid inlet and a fluid outlet fluidly connected with a conduit lumen;

an oxygen emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, the oxygen emitter including a plurality of matched sets of anodes and cathodes wherein the matched sets of anodes and cathodes are mounted to stabilizing hardware such that the oxygen emitter is positioned within the conduit lumen ~~comprising an anode separated at a critical distance from a cathode both within an aqueous medium and in aqueous communication with each other,~~; and

a power source ~~all~~ in electrical communication with ~~each other, wherein~~ the oxygen emitter ~~is placed within or adjacent to a conduit for flowing water~~.

2. (Currently Amended) The flow through oxygenator ~~emitter~~ of claim 1, wherein ~~the~~ each anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide and ~~the~~ each cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

3. (Currently Amended) The flow through oxygenator ~~critical distance~~ of claim 1, wherein the anode and cathode within each matched set are separated by a spacer such to maintain a gap of ~~which is~~ 0.005 to 0.140 inches between the anode and cathode.

4. (Currently Amended) The flow through oxygenator ~~critical distance~~ of claim ~~1~~ 3, wherein the gap ~~which~~ is 0.045 to 0.060 inches.

5. (Withdrawn) The product of claim 1 wherein the water is supersaturated with oxygen and of an approximately neutral pH.

6. (Withdrawn) A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

7. (Withdrawn) The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

8. (Withdrawn) A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

9. (Currently Amended) The flow through oxygenator ~~emitter~~ of claim 1 wherein ~~the~~ each anode is platinum and iridium oxide on a support and ~~the~~ each cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

10. (Withdrawn) A method to increase the oxygen content of flowing water comprising passing flowing water through a conduit comprising the flow-through oxygenator of claim 1.

11. (Withdrawn) The method of claim 11 wherein the flowing water has a temperature of 1 to 40 degrees Celsius.

12. (Withdrawn) The method of claim 11 wherein the flowing water becomes supersaturated with oxygen.

13. (New) The flow through oxygenator of claim 1, wherein the power source is electrically connected to the stabilizing hardware for powering the plurality of matched sets of anodes and cathodes.

14. (New) The flow through oxygenator of claim 1, wherein the plurality of matched sets comprises three matched sets of anodes and cathodes attached to the stabilizing hardware in adjacent relation such that each matched set resides at a 120° angle to the adjacent matched sets.

15. (New) The flow through oxygenator of claim 1, wherein the plurality of matched sets of anodes and cathodes are attached to the stabilizing hardware with the anodes proximate a conduit wall and the cathodes proximate a conduit center.

16. (New) The flow through oxygenator of claim 1, wherein the conduit lumen comprises a main flow portion and a side arm flow portion and wherein the oxygen emitter is positioned within the side arm flow portion using the stabilizing hardware.

17. (New) The flow through oxygenator of claim 1, wherein the plurality of matched sets of anodes and cathodes define plates positioned parallel to a flow axis of the conduit lumen.

18. (New) The flow through oxygenator of claim 1, wherein each cathode comprises a mesh screen.

19. (New) The flow through oxygenator of claim 1, further comprising:

a controller selectively operating the power source, such that the power source supplies power to the plurality of matched sets of anodes and cathodes when the aqueous

medium is flowing through the conduit lumen and withholds power when the aqueous medium is not flowing through the conduit lumen.

20. (New) The flow through oxygenator of claim 1, wherein the oxygen emitter is sized to generate oxygen sufficient to form a supersaturated aqueous medium.

21. (New) The flow through oxygenator of claim 1, wherein the aqueous medium is water.

22. (New) The flow through oxygenator of claim 21, wherein the oxygen emitter is sized to generate oxygen sufficient to form superoxygenated water.

23. (New) The flow through oxygenator of claim 1, wherein the fluid conduit is a watering hose.

24. (New) The flow through oxygenator of claim 1, wherein the fluid conduit is a hydroponic circulating system.

25. (New) A flow through oxygenator comprising:

a watering hose having a hose lumen; and

an oxygen emitter operably mounted within the hose lumen.

26. (New) A flow through oxygenator comprising:

a hydroponic circulating system having a circulating lumen; and

an oxygen emitter operably mounted within the circulating lumen.

REMARKS

Claims 1-4 and 9-12 are pending. By this Amendment, claims 1-4 and 9 are amended, new claims 13-26 are added and claims 10-12 are withdrawn. Claims 5-8 have been previously withdrawn. Support for the amendments can be found in the application, figures and claims as originally filed and more specifically at Page 4, Lines 18-28 and Page 13, Line 22 – Page 15, Line 12 as well as Figure 7. No new matter is introduced by way of the present amendments.

Status of Claims

By way of the present amendment, claims 1-4, 9 and new claims 13-26 are presently pending with claims 5-8 and 10-12 being presently or previously withdrawn.

Election/Restrictions

Applicant respectfully acknowledges the constructive election of claims 1-4 and 9.

Terminal Disclaimer

Claims 1-4 and 9 were previously rejected on the ground of nonstatutory obviousness-type double patenting. Applicant respectfully asserts that the need for a Terminal Disclaimer to overcome a nonstatutory obviousness-type double patenting rejection has been overcome through the present amendment to independent claim 1 and the addition of new independent claims 25 and 26. As claims 1, 25 and 26 are patently distinct from claims 1-6 of U.S. Patent No. 6,689,262, Applicant respectfully requests said rejections be withdrawn.

Claim Rejections – 35 USC §102

In the Office Action mailed May 24, 2007, claims 1-3 were rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,328,875 to Zappi et al. In response, Applicant presents amended claim 1 to further clarify the presently claimed invention. With the present response, Applicant has amended independent claim 1 to clarify the presently claimed flow through oxygenator as comprising an oxygen emitter positioned within a conduit lumen of a fluid conduit.

Zappi et al. discloses an electrolytic apparatus and related methods of use for the electropurification of contaminated aqueous media. Zappi et al. discloses the use of an electrolytic cell in an "open configuration" allowing for the controlled leakage of aqueous electrolyte solution and gaseous by-products (See Col. 4, Lines 9-43, Col. 5, Line 23 – Col. 6, Line 10, Col. 6, Lines 24-50 and Figures 1, 2 and 3). While Zappi et al. discusses the use of a conduit means (Col. 3, Lines 52-54) or pipe (Col. 14, Lines 23-37) for feeding aqueous electrolyte solution to the electrodes in the electrolyzer zone (Col. 3, Lines 52-54), Zappi et al. is absent any disclosure relative to the positioning of an oxygen emitter directly within the conduit lumen of a fluid conduit as presently claimed. Further evidence of Zappi et al.'s lack of disclosure relative to the positioning of an oxygen emitter within a conduit lumen of a fluid conduit are the repeated references to an ability to increase residency/retention time of the aqueous solution. As Zappi et al. fails to disclose each and every element of presently amended independent claim 1, Applicant respectfully requests said rejection be withdrawn.

Claim Rejections – 35 USC §103

In the Office Action mailed May 24, 2007, claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Zappi . As discussed above, Zappi et al. fails to disclose an oxygen emitter positioned within a conduit lumen of a fluid conduit as presently claimed in independent claim 1. As such, Zappi et al. fails to establish a *prima facie* case of obviousness with respect to independent claim 1. Applicant respectfully requests said rejection be withdrawn.

In the Office Action mailed May 24, 2007, claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over Zappi in view of U.S. Patent No. 4,587,001 to Cairns et al. As discussed above, Zappi et al. fails to disclose the positioning of an oxygen emitter within the conduit lumen of a fluid conduit. Cairns et al. is directed solely to a cathode having a metallic substrate and is absent any teaching, suggestion or motivation relative to the positioning of an oxygen emitter within the conduit lumen of a fluid conduit. As such, neither Zappi et al. nor Cairns et al., considered individually or combination, establish a *prima facie* case of obviousness with respect to presently amended independent claim 1. Applicant respectfully requests said rejection be withdrawn.

In the Office Action mailed May 24, 2007, claims 1-4 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,225,401 to Divisek et al. As admitted in the Office Action mailed May 24, 2007, Divisek does not teach an electrolyzer placed directly within a conduit as presently claimed in amended independent claim 1. Contrary to the assertions within the office action, there is simply no support that would lead one of skill in the art, utilizing either the explicit disclosure of Divisek or simple "common sense" to position the electrolyzer of Divisek adjacent to a fluid conduit let alone within the fluid conduit as presently

claimed. The teachings of Divisek in which anode and cathode chambers are separated by a specified separator and preferred operation of the invention is conducted at temperatures of 300°C to 600°C could not possibly teach, suggest or motivate one of skill in the art to consider positioning the electrolyzer either adjacent to or directly within a fluid conduit as presently claimed within independent claim 1. As such, Divisek et al. fails to establish a case of *prima facie* obviousness with respect to presently amended independent claim 1. Applicant respectfully requests said rejection be withdrawn.

In the Office Action mailed May 24, 2007, claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek et al. in view of Cairns et al. As discussed previously, neither Divisek et al. nor Cairns et al., considered individually or in combination, teach or suggest the positioning of an oxygen emitter directly within a conduit lumen of a fluid conduit. As such, the proposed combination of Divisek et al. and Cairns et al. fails to establish a *prima facie* case of obviousness with respect to presently amended independent claim 1. Applicant respectfully requests said rejection be withdrawn.

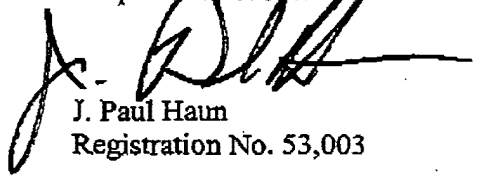
New Claims

Newly added independent claims 25 and 26 each contain the structural limitation of an oxygen emitter being operably mounted within a conduit lumen of a conduit. As discussed previously with respect to the present rejections to independent claim 1, none of the presently cited art considered individually or in combination teaches the positioning of an oxygen emitter directly within a conduit lumen of a fluid conduit. As such, Applicant respectfully asserts that newly added independent claims 25 and 26 are in condition for allowance.

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,



J. Paul Haun
Registration No. 53,003

Customer No. 24113
Patterson, Thuente, Skaar & Christensen, P.A.
4800 IDS Center
80 South 8th Street
Minneapolis, Minnesota 55402-2100
Telephone: (612) 349-3009

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:	Attorney Docket No.: 4056.02US01
James Andrew Senkiw	Confirmation No.: 7020
Application No.: 10/732,326	Examiner: Zheng, Lois L.
Filed: December 10, 2003	Group Art Unit: 1742
For: FLOW-THROUGH OXYGENATOR	

SUBSTITUTION OF ATTORNEY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I hereby appoint the practitioners associated with **Customer Number 24113** to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Address all telephone calls to: J. Paul Haun at telephone number (612) 349-3009.

Address all correspondence to:

Customer Number 24113
J. Paul Haun
Patterson, Thuente, Skaar & Christensen, P.A.
4800 IDS Center, 80 South 8th Street
Minneapolis, Minnesota 55402-2100

Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 16-0631.

CERTIFICATE OF MAILING

I hereby certify that this document is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

8/17/07
Date of Deposit

J. Paul Haun

Application No. 10/732,326

Please reference Attorney Docket No. 4056.02US01 on all correspondence. Additionally, please charge any future fees to Deposit Account No. 16-0631.

All previous powers of attorney granted in this case are hereby revoked.

Aqua Innovations, Inc., Assignee

Date: 8-15-07

Signature

Richard L. Disrud

Name Printed or Typed

COO

Title

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:	Attorney Docket No.: 4056.02US01
James Andrew Senkiw	Confirmation No.: 7020
Application No.: 10/732,326	Examiner: Zheng, Lois L.
Filed: December 10, 2003	Group Art Unit: 1742
For: FLOW-THROUGH OXYGENATOR	

CERTIFICATE UNDER 37 CFR § 3.73(b)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Aqua Innovations, Inc., a corporation, states that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of either:

A. [X] An assignment from the inventor(s) of the patent application identified above. The assignment was recorded in the Patent and Trademark Office at Reel 017998, Frame 0954, or for which a copy thereof is attached.

OR

B. [ ] A chain of title from the inventor(s), of the patent application identified above, to the current assignee as shown below:

1. From _____ to _____

The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____ or for which a copy thereof is attached.

2. From _____ to _____

The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____ or for which a copy thereof is attached.

3. From _____ to _____

The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____ or for which a copy thereof is attached.

[ ] Additional documents in the chain of title are listed on a supplemental sheet.

[ ] Copies of assignments or other documents in the chain of title are attached.

The undersigned (whose title is supplied below) is empowered to sign this statement on behalf of the assignee.

Date: 8-15-07

Richard L. Disrud
Signature

Richard L. Disrud
Name Printed or Typed

COO
Title

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 08/21/2007

CQUEEN	SALE	#00000002	Mailroom Dt:	08/17/2007		160631	10732326
		01	FC : 2202	150.00	DA		
		02	FC : 2201	100.00	DA		

PTO/SB/06 (08-03)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/732,586

CLAIMS AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE (37 CFR 1.16(a))				$	OR		$
TOTAL CLAIMS (37 CFR 1.16(c))	minus =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus =	*	X $ =		OR	X $ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))			+ $ =		OR	+ $ =	
* If the difference in column 1 is less than zero, enter "0" in column 2			TOTAL		OR	TOTAL	

CLAIMS AS AMENDED – PART II

8-1707

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
AMENDMENT A	Total (37 CFR 1.16(c))	26	Minus	** 20	= 6	X $ 25 =	150	OR	X $ =	
	Independent (37 CFR 1.16(b))	4	Minus	*** 3	= 1	X $ 100 =	100	OR	X $ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =	—	OR	+ $ =	
						TOTAL ADD'L FEE	250	OR	TOTAL ADD'L FEE	
AMENDMENT B	Total (37 CFR 1.16(c))		Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(b))		Minus	***	=	X $ =		OR	X $ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT C	Total (37 CFR 1.16(c))		Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(b))		Minus	***	=	X $ =		OR	X $ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" IN THIS SPACE is the highest number found in the appropriate box in column 1.

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/732326	
Examiner	**Art Unit**

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date								
Final	Original									
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	11									
	12									
	13									
	14									
	15									
	16									
	17									
	18									
	19									
	20									
	21									
	22									
	23									
	24									
	25									
	26									
	27									
	28									
	29									
	30									
	31									
	32									
	33									
	34									
	35									
	36									
	37									
	38									
	39									
	40									
	41									
	42									
	43									
	44									
	45									
	46									
	47									
	48									
	49									
	50									

Claim		Date								
Final	Original									
	51									
	52									
	53									
	54									
	55									
	56									
	57									
	58									
	59									
	60									
	61									
	62									
	63									
	64									
	65									
	66									
	67									
	68									
	69									
	70									
	71									
	72									
	73									
	74									
	75									
	76									
	77									
	78									
	79									
	80									
	81									
	82									
	83									
	84									
	85									
	86									
	87									
	88									
	89									
	90									
	91									
	92									
	93									
	94									
	95									
	96									
	97									
	98									
	99									
	100									

Claim		Date								
Final	Original									
	101									
	102									
	103									
	104									
	105									
	106									
	107									
	108									
	109									
	110									
	111									
	112									
	113									
	114									
	115									
	116									
	117									
	118									
	119									
	120									
	121									
	122									
	123									
	124									
	125									
	126									
	127									
	128									
	129									
	130									
	131									
	132									
	133									
	134									
	135									
	136									
	137									
	138									
	139									
	140									
	141									
	142									
	143									
	144									
	145									
	146									
	147									
	148									
	149									
	150									

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/732,326	SENKIW, JAMES ANDREW	
		Zheng	1742

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 2-28-07	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by: Argue

U.S. Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQI.002US1	7020

7590 05/24/2007

Kathleen R. Terry
#314
1666 Coffman Street
Falcon Heights, MN 55108

EXAMINER	
ZHENG, LOIS L	
ART UNIT	PAPER NUMBER
1742	
MAIL DATE	DELIVERY MODE
05/24/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	Lois Zheng	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6-12* is/are pending in the application.

4a) Of the above claim(s) *6-8 and 10-12* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 27 March 2007 has been entered.

Status of Claims

2. Claim 1 is amended in view of the claim amendment filed 27 March 2007. New claims 10-12 are added in view of the claim amendment. Claims 6-8 remain withdrawn from consideration. Therefore, claims 1-4 and 9-12 are currently under examination.

Note, previously withdrawn claim 5 is missing in the claims filed 27 March 2007.

Election/Restrictions

3. Newly submitted claims 10-12 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

New claims 10-12 and claims 1-3 and 9 are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as recited in claims 1-3 and 9

can be used to practice another and materially different process such as a process to produce hydrogen and oxygen.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 10-12 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Specification

4. The amendment to the specification filed on 27 March 2007 is entered.

Terminal Disclaimer

5. The terminal disclaimer filed 28 February 2007 is improper because:

The application/patent being disclaimed has been improperly identified since the number used to identify the application number 10/372,017 being disclaimed is incorrect. The correct number is US Patent No. 6,689,262 B2.

Status of Previous Rejections

6. The rejection of claims 1-4 and 9 under 35 U.S.C. 112, second paragraph, is withdrawn in view of applicant's claim amendments filed 27 March 2007.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the

applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1-3 are rejected under 35 U.S.C. 102(e) as being anticipated by Zappi et al. US 6,328,875 B1(Zappi).

Zappi teaches an electrolytic apparatus for electropurification of water(abstract), wherein the apparatus comprises a water feed, at least one cathode and at least one anode with inter-electrode gap between 0-2mm(Fig. 1 #12,18 and 20, col. 10, lines 13-15, col. 12 lines 45-49).

Regarding claims 1 and 3, Zappi teaches the generation of oxygen gas(Fig. 1). Therefore, the claimed electrolytic generation of microbubbles of oxygen inherently takes place when the electrolytic apparatus of Zappi is in operation. The inter-electrode distance of 0-2mm reads on the claimed critical distance from anode to cathode. Since the apparatus of Zappi is used to process water, the examiner concludes that the anode and the cathode in the apparatus of Zappi are both within an aqueous medium as claimed based on the broadest reasonable interpretation. In addition, Fig. 1 of Zappi further teaches that purified water drips from the electrode, which implies that the anode and the cathode as taught by Zappi are in aqueous communication with each other as claimed. The claimed power source is inherently present in the electrolytic apparatus of Zappi in order for it to be operational. Furthermore, the electrolytic apparatus as taught by Zappi is place adjacent to a conduit for flowing water(Fig. 1#22).

Regarding claim 2, Zappi further teaches that the anode and the cathode are a metal or metal oxide as claimed.

Therefore, Zappi electrolytic apparatus anticipates the claimed flow-through oxygenator and the claimed emitter.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zappi.

The teachings of Zappi are discussed in paragraph 8 above.

Regarding claim 4, the distance of 0-2mm between the electrodes as taught by Zappi encompasses the claimed critical distance of 0.045 to 0.060 inches.

Therefore, a prima facie case of obviousness exists. See MPEP 2144.05. The selection of claimed critical distance from the disclosed range of Zappi would have been obvious to one skilled in the art since Zappi teaches the same utilities in its' disclosed critical distance range.

11. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zappi in view of Cairns et al. US 4,587,001(Cairns).

The teachings of Zappi are discussed in paragraph 8 above.

However, Zappi does not explicitly teach the claimed anode being platinum and iridium oxide on a support.

Cairns teaches an cathode for use in an electrolytic cell(abstract). Cairns further teaches an titanium anode having a electro-catalytically active coating material

comprising one or more oxides of platinum group metals such as platinum and iridium(col. 5 lines 15-25).

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the anode of Cairns into the electrolyzer of Zappi as the anode since Cairns teaches that platinum group metal oxides is a good electro-catalytically active material for an anode of an electrolytic cell and the application of such coating on an anode is well known in the art(col. 5 lines 15-16 and 32-33).

12. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek et al. US 4,225,401(Divisek).

Divisek teaches a water electrolyzer for generating hydrogen and oxygen(abstract). The water electrolyzer comprises and anode separated at a distance from a cathode(Fig. 1), wherein both the anode and the cathode are within an aqueous medium as claimed. Divisek further teaches that the distance between the electrodes is about 1-3 mm(col. 3 lines 54-61).

Regarding instant claims 1 and 3, since the water electrolyzer of Divisek produces oxygen, the claimed oxygen microbubbles is inherently electrolytically generated when Divisek's water electrolyzer is in operation. In addition, Divisek teaches the claimed anode and cathode separated about 1-3 mm apart from each other, which reads on the claimed critical distance as recited in instant claim 3. The claimed power source is also inherently present in the water electrolyzer of Divisek. Furthermore, Divisek further teaches transfer of electrolyte from cathode chamber to anode chamber takes place in order to equalize the mass balance(col. 3 lines 47-50).

Therefore, the anode and the cathode are in aqueous communication with each other in the apparatus of Divisek.

Even though Divisek does not explicitly teach that its electrolyzer is place within or adjacent to a conduit for flowing water, one of ordinary skill in the art would have found the position of Divisek's electrolyzer at least adjacent to a water conduit obvious since water is added/fed to Devisek's electrolyzer for electrolysis to take place.

Therefore, the claimed flow-through oxygenator and the claimed emitter do not structurally distinguish from the water electrolyzer of Divisek.

Regarding claim 2, Divisek further teaches that the anode and the cathode are made of nickel(col. 4 lines 37-39), which meets the limitation of claimed metal anode and metal cathode.

Regarding claim 4, the distance of 1-3mm between the electrodes as taught by Divisek encompasses the claimed critical distance of 0.045 to 0.060 inches.

Therefore, a prima facie case of obviousness exists. See MPEP 2144.05. The selection of claimed critical distance from the disclosed range of Divisek would have been obvious to one skilled in the art since Divisek teaches the same utilities in its' disclosed critical distance range.

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek in view of Cairns et al. US 4,587,001(Cairns).

The teachings of Divisek are discussed in paragraph 12 above.

However, Divisek does not explicitly teach the claimed anode being platinum and iridium oxide on a support.

Cairns teaches an cathode for use in an electrolytic cell(abstract). Cairns further teaches an titanium anode having a electro-catalytically active coating material comprising one or more oxides of platinum group metals such as platinum and iridium(col. 5 lines 15-25).

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the anode of Cairns into the electrolyzer of Divisek as the anode since Cairns teaches that platinum group metal oxides is a good electro-catalytically active material for an anode of an electrolytic cell and the application of such coating on an anode is well known in the art(col. 5 lines 15-16 and 32-33).

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., In re Berg, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); In re Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); In re Longi, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); In re Van Ornum, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and In re Thorington, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

15. Claims 1-4 and 9 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 6,689,262 B2. Although the conflicting claims are not identical, they are not patentably distinct from each other because the emitter of U.S. Patent No. 6,689,262 B2 is structurally the same as the emitter of the claimed flow-through oxygenator. Even though U.S. Patent No. 6,689,262 B2 does not explicitly teach the claimed flow through oxygenator, one of ordinary skill in the art would have found it obvious to use the instant emitter in an oxygenator as claimed since the emitter produces oxygen.

Response to Arguments

16. Applicant's arguments filed 27 March have been fully considered but they are not persuasive.

In the remarks, applicant argues that Divisek teaches the use of a separator for separating the anode and the cathode into anode and cathode chambers. This separator is not present in the instant invention.

The examiner does not applicant's argument persuasive since the instant claim 1 uses open-ended transitional phase "comprising", which allows the presence of additional structural components in the claimed emitter, such as the separator as taught by Divisek.

Applicant further argues that Divisek does not teach that the water electrolyzer is placed within a conduit for flowing water.

The examiner does not find applicant's argument persuasive. As stated in paragraph 12 above, even though Divisek does not explicitly teach that its electrolyzer

is place within or adjacent to a conduit for flowing water, one of ordinary skill in the art would have found the position of Divisek's electrolyzer at least adjacent to a water conduit obvious since water is added/fed to Devisek's electrolyzer for electrolysis to take place.

Applicant further argues that cathode is not located in an aqueous medium since the operating temperature as taught by Divisek is in the range of 300-600C. Therefore, any water would be in vapor form not in liquid form. The examiner does not find applicant's argument persuasive since the phase of water electrolyte depends upon the electrolysis operating temperature, therefore, is directed to a process limitation. As stated in MPEP 2114 [R-1], it is well settled that the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus as long as the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). In this case, since the apparatus as taught by Divisek is substantially the same structurally as the claimed apparatus, the examiner concludes that the rejection is proper.

Applicant's arguments with respect to claims 2, 4 and 9 are not found convincing since they are depended upon the non-convincing arguments of claim 1 above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lois Zheng whose telephone number is (571) 272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LLZ

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

Notice of References Cited	Application/Control No. 10/732,326	Applicant(s)/Patent Under Reexamination SENKIW, JAMES ANDREW	
	Examiner Lois Zheng	Art Unit 1742	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,328,875	12-2001	Zappi et al.	205/500
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
10/732,326	SENKIW, JAMES ANDREW	
Examiner	**Art Unit**	
Lois Zheng	1742	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
inventorship search	5/22/2007	LLZ
Updated EAST search	5/22/2007	LLZ

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	12	("4252856"|"5534143"|"5982609"|"6315886"|"6394429"|"6689262"). PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:18
L2	7	james near2 senkiw	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:19
L5	19	4 not 2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:20
L3	390	(micro adj bubble microbubble) with oxygen	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:20
L4	24	3 and anode and cathode	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:23
L6	2866	(anode cathode electrode) with (spacing spaced distance gap) with (mm millimeter) and oxygen and hydrogen and water	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:25
L7	744	6 and ("204" "205").clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 15:26
L9	1	"4048047".pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 17:10

EAST Search History

L8	282	6 and ("204" "205").clas. and (electrolytic electrolysis electrolyz$4) near3 water	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 17:11
L10	15	8 and anode with (platinum Pt) with (iridium near2 oxide "IrO.sub.2")	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/05/22 17:12

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	10/732,326
Applicant	James A. Senkiw.
Filed	12/10/2003
Art Unit	1742
Examiner	Lois L. Zheng

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE AND AMENDMENT
AFTER FINAL REJECTION

Dear Ms. Zheng:

Enclosed please find a response to the Office action of 02-05-2007. Please enter the Terminal Disclaimer over a Provisional Patent Application filed on February 24, 2007

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 5 of this paper.

Amendments to the Specification:

Please replace the RELATED APPLICATIONS on page 1 of this application with the following:

> This application is a continuation-in-part of United States Patent Application Number 10/372,017, filed on February 21, 2003, now United States Patent Number 6,689,262, issued February 10, 2004, which claims priority to United States Provisional Patent Application Number 60/358,534, filed February 22, 2002.

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1. (Currently amended) A flow-through oxygenator consisting of ~~comprising~~ an emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, comprising an anode separated at a critical distance from a cathode both within an aqueous medium and in aqueous communication with each other, and a power source all in electrical communication with each other, wherein the emitter is placed within or adjacent to a conduit for flowing water.

Claim 2. (Previously presented) The emitter of claim 1 wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 3. (Original) The critical distance of claim 1 which is 0.005 to 0.140 inches.

Claim 4. (Original) The critical distance of claim 1 which is 0.045 to 0.060 inches.

Claim 6. (Withdrawn) A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

Claim 7. (Withdrawn) The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

Claim 8. (Withdrawn) A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

Claim 9. (Previously presented) The emitter of claim 1 wherein the anode is platinum and iridium oxide on a support and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 10. (New) A method to increase the oxygen content of flowing water comprising passing flowing water through a conduit comprising the flow-through oxygenator of claim 1.

Claim 11. (New) The method of claim 11 wherein the flowing water has a temperature of 1 to 40 degrees Celsius.

Claim 12. (New) The method of claim 11 wherein the flowing water becomes supersaturated with oxygen.

REMARKS/ARGUMENTS

The specification has been amended to correct the error in the response to the Office Action of 9 November 2006, to properly place the update of status of related applications on page 1 of the specification. New claims 10-12 are presented.

The Examiner has rejected claims 1, and claims 2-4 and 9 which depend on claim 1, under 35 U.S.C.§ 112, second paragraph, as being indefinite for not clearly pointing out that both the cathode and the anode are in an aqueous medium. Claim 1 as amended now recites that both anode and cathode are in an aqueous medium, and are in aqueous communication with each other. Applicant believes that amended claim 1 and the claims dependant on claim 1 satisfy 35 U.S.C. § 112, second paragraph.

The Examiner has rejected pending claims 1and 3 under U.S.C. § 102(b) as being anticipated by Divisek et al. US 4,225,401 ("Divisek"). Applicant respectfully disagrees. Claim 1 has been amended to emphasize that unlike Divisek, the electrodes are not separated by a separator, but are both in aqueous medium and in aqueous communication with each other. It can be seen in Figure 1 that Divisek places his anode and cathode in two separate chambers. The abstract states in lines 4-5 that the anode and cathode chambers are separated from one another by a separator, which prevents aqueous communication. See also claim 1 of Divisek.

The Examiner further states that Figure 1 of Divisek shows that the "water electrolyzer" is placed within a conduit for flowing water. Applicant disagrees with that reading of Divisek. Figure 1, the abstract and all the examples of Divisek disclose that the electrolysis cell is static, that in, placed in two chambers, not a conduit. Furthermore, the Examiner is requested to take notice that water does not flow at the temperatures taught by Divisek, that is, 300 to 600 degrees Celsius, at which temperature H_2O exists as water vapor, not water. See Compact Edition of the Oxford English Dictionary (Oxford University Press, Oxford, England, 1971): "water- the *liquid* of which seas, lakes and rivers are composed." (Emphasis added.)

The Examiner further states that Divisek discloses a cathode located in an aqueous medium. Applicant respectfully disagrees. As stated above, Divisek does not disclose the presence of water, a liquid, which does not exist at the temperatures he discloses, but discloses water vapor, the gaseous, not the liquid, phase of H_2O (column 3, lines 2-4 and column 4, lines 56-58). His cathode is therefore not in an aqueous medium. Turning again to the Oxford English Dictionary, aqueous is defined as "1. of, or pertaining to, the nature of water; watery..." Also noted is the recitation on page 14, lines 10-12 of the specification that the present invention is operated at ambient temperature, that is, 10 to 12 degrees Celsius, at which temperature the substrate of Divisek would be a solid matter. This limitation is found in new claim 11.

The Examiner states that Divisek teaches the composition of the anode and cathode, thereby meeting the limitations of claim 2. Claim 2 is dependant on claim 1, which Applicant believes is patentable over Divisek. Divisek does not include the limitations of claim 1 and therefore does not anticipate claim 2.

The Examiner has rejected claim 4 under U.S.C. §103 (a) as being obvious from Divisek. Divisek is actually silent as to the distance between electrodes in his working examples 1 to 3. On column 3, lines 57-61, Divisek states that "distance between the electrodes which merely corresponds to the thickness of the separator are possible, in other words, for all practical purposes, this distance may amount to about 1-3 mm." While 1-3 mm overlaps with the critical distance recited in claim 4, claim 4 depends on claim 1 and includes all the limitations of claim 1, since claim1 has now been distinguished from Divisek, it is submitted that the rejection of claim 4 now longer applies.

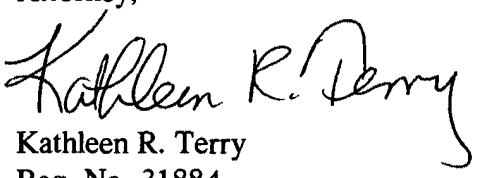
The Examiner has rejected claim 9 under 35 U.S.C. § 103 (a) as being obvious from Divisek in view of Cairns et al U.S. 4,587,001. Claim 9 being dependant from claim 1, it should be read with all the limitationss of claim 1. The invention to be operative is not dependant on any specific anodes and cathodes (specification, page 4, line 1-8) but the platinum and iridium electrodes are more durable and thence comprise the best mode of making the invention. Applicant believes that claim 9 is now allowable.

The Examiner has rejected claim 1-4 on the ground of non-statutory obviousness-type double patenting over claims 1-6 of U.S. Patent 6,689,262B2. The Examiner points out that the open-ended transitional term "comprising" can include Divisek's separator. Claim 1 as amended now reads "consisting of" a closed-ended term that does not allow the inclusion of Divisek's separator. Applicant has submitted a Terminal Disclaimer which obviates this rejection

New claims 10-12 are presented to illustrate to the public how the invention is to be practiced. Support for these claims can be found in the specification, page 6, line15-16 and page 14, lines 10-12 and line 21. Page 14, lines 10-12 described the flowing water at ambient temperature, that is about 10 to 12 degrees Celsius. On page 14, line 21, the flowing water is described as supersaturated and milky with dissolved oxygen. Supersaturated is defined on page 6, line 15-16.

The claims being amended to more distinctly claim the invention, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
Applicant James A. Senkiw, by his Attorney,



Kathleen R. Terry
Reg. No. 31884
(651) 659-9819
Krterry@visi.com

Please direct all correspondence to:
Kathleen R. Terry
1666 Coffman Street #314
Falcon Heights, MN 55108

PTO/SB/30 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/732,326
Filing Date	12=03=2003
First Named Inventor	James Andrew Senkiw
Art Unit	1742
Examiner Name	Lois Zheng
Attorney Docket Number	AQI.002US1

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☐ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. _____. I have enclosed a duplicate copy of this sheet.

      i. ☐ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   03/28/2007 HGUTEMA1 00000028 10732326
   01 FC:2801 395.00 OP

   b. ☑ Check in the amount of $ 395 enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	Kathleen R. Terry	Date	21 March 2007
Name (Print/Type)	Kathleen R. Terry	Registration No.	31,884

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	Kathleen R. Terry		
Name (Print/Type)	Kathleen R. Terry	Date	

PTO/SB/17 (02-07)
Approved for use through 02/28/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2007

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 395

Complete if Known	
Application Number	10/732,326
Filing Date	12-03-2003
First Named Inventor	James A. Senkiw
Examiner Name	Lois Zheng
Art Unit	1742
Attorney Docket No.	AQI.002US1

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☐ Deposit Account Deposit Account Number: _____ Deposit Account Name: _____

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims	Fee ($)		Fee Paid ($)
_____	- 20 or HP =	_____	x _____	=	_____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		Extra Claims	Fee ($)		Fee Paid ($)
_____	- 3 or HP =	_____	x _____	=	_____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof		Fee ($)		Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____	(round **up** to a whole number) x	_____	=	_____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	_____
Other (e.g., late filing surcharge): RCE	395

SUBMITTED BY

Signature	Kathleen R. Terry	Registration No. (Attorney/Agent) 31884	Telephone 651 659 9819
Name (Print/Type)	Kathleen R. Terry		Date 21 March 2007

KATHLEEN R. TERRY
1656 COFFMAN STREET, #314
FALCON HEIGHTS, MN 55108

22-70/960 [redacted]

21 Mar 20 07

PAY TO THE ORDER OF USPTO $ 395

Three hundred ninety-five only DOLLARS

PARK MIDWAY BANK
2265 COMO AVE.
ST. PAUL, MN 55108
(651) 523-7800

FOR AQ1.002US, RCE

Kathleen R. Terry

[redacted]

PTO/SB/21 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission: 10

Application Number	10/732,326
Filing Date	12-03-2003
First Named Inventor	James Andrew Senkiw
Art Unit	1742
Examiner Name	Lois Zheng
Attorney Docket Number	AQI.002US1

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [x] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Remarks

RCE
Return postcard

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Kathleen R. Terry		
Signature	Kathleen R. Terry		
Printed name	Kathleen R. Terry		
Date	21 March 2007	Reg. No.	31884

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Kathleen R. Terry		
Typed or printed name	Kathleen R. Terry	Date	21 March 2007

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
10/732,326	12/10/2003	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY ☒ FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 11/09/2006	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 9	Minus	** 20	= 0	X $25 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	X $100 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

3.27.07

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
catherine d. smith

10/732326

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQI.002US1	7020

7590 03/15/2007

Kathleen R. Terry
#314
1666 Coffman Street
Falcon Heights, MN 55108

EXAMINER	
ZHENG, LOIS L	
ART UNIT	PAPER NUMBER
1742	

MAIL DATE	DELIVERY MODE
03/15/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

Advisory Action Before the Filing of an Appeal Brief	**Application No.**	**Applicant(s)**	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	**Art Unit**	
	Lois Zheng	1742	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 28 February 2007 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☒ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☒ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: *1-4 and 9*.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

Continuation of 3. NOTE: The new claim amendments change the scope of the finally rejected claims, therefore, require further search and consideration.

Continuation of 11. does NOT place the application in condition for allowance because: Applicant's argument are based on newly amended claims that change the scope of the finally rejected claims. The new claim amendments require further search and consideration.

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	10/732,326
Applicant	James A. Senkiw.
Filed	12/10/2003
Art Unit	1742
Examiner	Lois L. Zheng

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE AND AMENDMENT
AFTER FINAL REJECTION

Dear Ms. Zheng:

Enclosed please find a response to the Office action of 02-05-2007.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 4 of this paper.

Not Entered

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	10/732,326
Applicant	James A. Senkiw.
Filed	12/10/2003
Art Unit	1742
Examiner	Lois L. Zheng

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE AND AMENDMENT
AFTER FINAL REJECTION

Dear Ms. Zheng:

Enclosed please find a response to the Office action of 02-05-2007.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 4 of this paper.

Amendments to the Specification:

Please replace the RELATED APPLICATIONS on page 1 of this application with the following:

> This application is a continuation-in-part of United States Patent Application Number 10/372,017, filed on February 21, 2003, now United States Patent Number 6,689,262, issued February 10, 2004, which claims priority to United States Provisional Patent Application Number 60/358,534, filed February 22, 2002.

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1. (Currently amended) A flow-through oxygenator consisting of ~~comprising~~ an emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, comprising an anode separated at a critical distance from a cathode both within an aqueous medium and in aqueous communication with each other, and a power source all in electrical communication with each other, wherein the emitter is placed within or adjacent to a conduit for flowing water.

Claim 2. (Previously presented) The emitter of claim 1 wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 3. (Original) The critical distance of claim 1 which is 0.005 to 0.140 inches.

Claim 4. (Original) The critical distance of claim 1 which is 0.045 to 0.060 inches.

Claim 6. (Withdrawn) A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

Claim 7. (Withdrawn) The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

Claim 8. (Withdrawn) A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

Claim 9. (Previously presented) The emitter of claim 1 wherein the anode is platinum and iridium oxide on a support and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

REMARKS/ARGUMENTS

The specification has been amended to correct the error in the response to the Office Action of 9 November 2006, to properly place the update of status of related applications on page 1 of the specification.

The Examiner has rejected claims 1, and claims 2-4 and 9 which depend on claim 1, under 35 U.S.C.§ 112, second paragraph, as being indefinite for not clearly pointing out that both the cathode and the anode are in an aqueous medium. Claim 1 as amended now recites that both anode and cathode are in an aqueous medium, and are in aqueous communication with each other. Applicant believes that amended claim 1 and the claims dependant on claim 1 satisfy 35 U.S.C. § 112, second paragraph.

The Examiner has rejected pending claims 1and 3 under U.S.C. § 102(b) as being anticipated by Divisek et al. US 4,225,401 ("Divisek"). Applicant respectfully disagrees. Claim 1 has been amended to emphasize that unlike Divisek, the electrodes are not separated by a separator, but are both in aqueous medium and in aqueous communication with each other. It can be seen in Figure 1 that Divisek places his anode and cathode in two separate chambers. The abstract states in lines 4-5 that the anode and cathode chambers are separated from one another by a separator, which prevents aqueous communication. See also claim 1 of Divisek.

The Examiner further states that Figure 1 of Divisek shows that the "water electrolyzer" is placed within a conduit for flowing water. Applicant disagrees with that reading of Divisek. Figure 1, the abstract and all the examples of Divisek disclose that the electrolysis cell is static, that in, placed in two chambers, not a conduit. Furthermore, the Examiner is requested to take notice that water does not flow at the temperatures taught by Divisek, that is, 300 to 600 degrees Celsius, at which temperature H_2O exists as water vapor, not water. See Compact Edition of the Oxford English Dictionary (Oxford University Press, Oxford, England, 1971): "water- the *liquid* of which seas, lakes and rivers are composed." (Emphasis added.)

The Examiner further states that Divisek discloses a cathode located in an aqueous medium. Applicant respectfully disagrees. As stated above, Divisek does not disclose the presence of water, a liquid, which does not exist at the temperatures he discloses, but discloses water vapor, the gaseous, not the liquid, phase of H_2O (column 3, lines 2-4 and column 4, lines 56-58). His cathode is therefore not in an aqueous medium. Turning again to the Oxford English Dictionary, aqueous is defined as "1. of, or pertaining to, the nature of water; watery..."

The Examiner states that Divisek teaches the composition of the anode and cathode, thereby meeting the limitations of claim 2. Claim 2 is dependant on claim 1, which Applicant

believes is patentable over Divisek. Divisek does not include the limitations of claim 1 and therefore does not anticipate claim 2.

The Examiner has rejected claim 4 under U.S.C. §103 (a) as being obvious from Divisek. Divisek is actually silent as to the distance between electrodes in his working examples 1 to 3. On column 3, lines 57-61, Divisek states that "distance between the electrodes which merely corresponds to the thickness of the separator are possible, in other words, for all practical purposes, this distance may amount to about 1-3 mm." While 1-3 mm overlaps with the critical distance recited in claim 4, claim 4 depends on claim 1 and includes all the limitations of claim 1, since claim1 has now been distinguished from Divisek, it is submitted that the rejection of claim 4 now longer applies.

The Examiner has rejected claim 9 under 35 U.S.C. § 103 (a) as being obvious from Divisek in view of Cairns et al U.S. 4,587,001. Claim 9 being dependant from claim 1, it should be read with all the limitationss of claim 1. The invention to be operative is not dependant on any specific anodes and cathodes (specification, page 4, line 1-8) but the platinum and iridium electrodes are more durable and thence comprise the best mode of making the invention. Applicant believes that claim 9 is now allowable.

The Examiner has rejected claim 1-4 on the ground of non-statutory obviousness-type double patenting over claims 1-6 of U.S. Patent 6,689,262B2. The Examiner points out that the open-ended transitional term "comprising" can include Divisek's separator. Claim 1 as amended now reads "consisting of" a closed-ended term that does not allow the inclusion of Divisek's separator. Applicant submits herewith a terminal disclaimer which obviates this rejection

The claims being amended to more distinctly claim the invention, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
Applicant James A. Senkiw, by his
Attorney,

Kathleen R. Terry

Kathleen R. Terry
Reg. No. 31884
(651) 659-9819
Krterry@visi.com

Please direct all correspondence to:
Kathleen R. Terry
1666 Coffman Street
Falcon Heights, MN 55108

PTO/SB/25 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION

Docket Number (Optional)

In re Application of: James A. Senkiw

Application No.: 10/732,326

Filed: 12/10/2003

For: FLOW THROUGH OXYGENATOR

The owner*, AQUAINNOVATIONS, INC, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 10/372,017, filed on 02/21/2003, as such term is defined in 35 U.S.C. 154 and 173, and as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent: granted on the pending **reference** application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 31,884

Kathleen R. Terry — February 24, 2007
Signature — Date

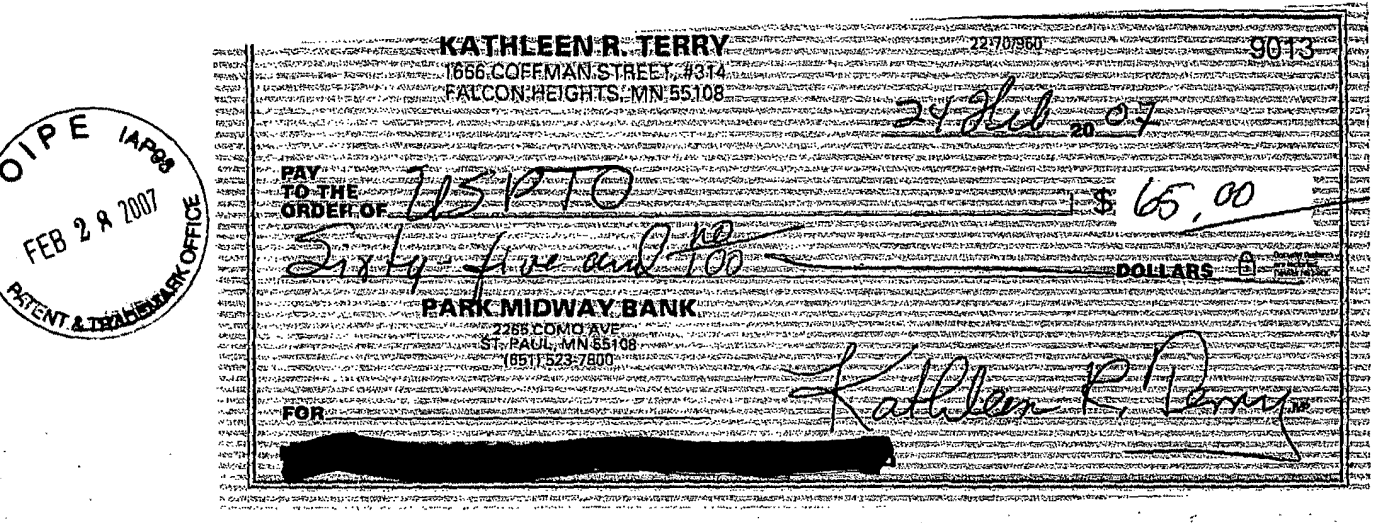
Kathleen R. Terry
Typed or printed name

651 659 9819
Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this statement. See MPEP § 324.



PTO/SB/17 (02-07)
Approved for use through 02/28/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2007

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) ~~130~~ 65

Complete if Known	
Application Number	10/732,326
Filing Date	12/10/2003
First Named Inventor	James A. Senkiw
Examiner Name	Lois Zheng
Art Unit	1742
Attorney Docket No.	AQI.002US1

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☐ Deposit Account Deposit Account Number: _____ Deposit Account Name: _____

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims	Fee ($)	Fee Paid ($)
_____	- 20 or HP =	_____	x _____	= _____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		Extra Claims	Fee ($)	Fee Paid ($)
_____	- 3 or HP =	_____	x _____	= _____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____ (round up to a whole number)	x _____	= _____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other (e.g., late filing surcharge): Terminal Disclaimer	~~130~~ 65

SUBMITTED BY

Signature	Kathleen R. Terry	Registration No. (Attorney/Agent) 31,884	Telephone 651 659 9819
Name (Print/Type)	Kathleen R. Terry		Date 24 February 2007

PTO/SB/21 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission: 10

Application Number	10/732,326
Filing Date	12-10-2003
First Named Inventor	James Senkiw
Art Unit	1742
Examiner Name	Lois Zheng
Attorney Docket Number	AQI.002US1

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [x] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [x] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Remarks

Post card

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature			
Printed name	Kathleen R. Terry		
Date	February 24, 2007	Reg. No.	31,884

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Kathleen R. Terry		
Typed or printed name	Kathleen R. Terry	Date	February 24, 2007

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQ1.002US1	7020

7590 02/05/2007

Kathleen R. Terry
#314
1666 Coffman Street
Falcon Heights, MN 55108

EXAMINER	
ZHENG, LOIS L	
ART UNIT	PAPER NUMBER
1742	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/05/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	Lois Zheng	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1-2 are amended in view of the amendments filed 9 November 2006. New claim 9 is added. Claims 5-8 remain withdrawn. Therefore, claims 1-4 and 9 are currently under examination.

Specification/Abstract

2. The amendment to the specification filed 9 November 2006 is not proper.

The amendment cannot be used to replace the abstract as requested by the applicant since the amendment includes continuing data which should be placed at the beginning of the specification.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-4 and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, the amended feature of "comprising an anode separated at a critical distance from a cathode within an aqueous medium" is vague and indefinite since it is unclear whether this limitation is directed to a cathode within an aqueous medium or to both an anode and a cathode each within an aqueous medium or to both an anode and an cathode within the same aqueous medium.

In this office action, the examiner is interpreting this amended feature to mean that an anode is separated at a critical distance from a cathode and the cathode is within an aqueous medium or that both the anode and the cathode are each within an aqueous medium.

Claims 2-4 and 9 are also rejected since they depend on rejected claim 1.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1- 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Divisek et al. US 4,225,401(Divisek).

Divisek teaches a water electrolyzer for generating hydrogen and oxygen(abstract). The water electrolyzer comprises and anode separated at a distance from a cathode(Fig. 1). Divisek further teaches that the distance between the electrodes is about 1-3 mm(col. 3 lines 54-61).

Regarding instant claims 1 and 3, since the water electrolyzer of Divisek produces oxygen, the claimed oxygen microbubbles is inherently electrolytically generated when Divisek's water electrolyzer is in operation. In addition, Divisek teaches the claimed anode and cathode separated about 1-3 mm apart from each other, which reads on the claimed critical distance as recited in instant claim 3. The claimed power source is also inherently present in the water electrolyzer of Divisek.

Fig. 1 of Divisek further shows that the water electrolyzer is placed within a conduit for flowing water Therefore, the water electrolyzer of Divisek meets the structural limitation of the instant claims 1 and 3. The examiner concludes that the electrolyzer of Divisek reads on the claimed flow-through oxygenator and the claimed emitter based on the broadest reasonable interpretation.

Regarding the amended feature in claim 1, the oxygen microbubbles are electrolytically generated from an aqueous medium in the water electrolyzer of Divisek. In addition, the cathode in the apparatus of Divisek is located within an aqueous medium as claimed.

Regarding claim 2, Divisek further teaches that the anode and the cathode are made of nickel(col. 4 lines 37-39), which meets the limitation of claimed metal anode and metal cathode.

Therefore, Divisek anticipates instant claims 1- 3.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek.

The teachings of Divisek are discussed in paragraph 6 above.

Regarding instant claim 4, the distance of 1-3mm between the electrodes as taught by Divisek encompasses the claimed critical distance of 0.045 to 0.060 inches.

Therefore, a prima facie case of obviousness exists. See MPEP 2144.05. The selection of claimed critical distance from the disclosed range of Divisek would have been obvious to one skilled in the art since Divisek teaches the same utilities in its' disclosed critical distance range.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek in view of Cairns et al. US 4,587,001(Cairns).

The teachings of Divisek are discussed in paragraph 6 above.

However, Divisek does not explicitly teach the claimed anode being platinum and iridium oxide on a support.

Cairns teaches an cathode for use in an electrolytic cell(abstract). Cairns further teaches an titanium anode having a electro-catalytically active coating material comprising one or more oxides of platinum group metals such as platinum and iridium(col. 5 lines 15-25).

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the anode of Cairns into the electrolyzer of Divisek as the anode since Cairns teaches that platinum group metal oxides is a good electro-catalytically active material for an anode of an electrolytic cell and the application of such coating on an anode is well known in the art(col. 5 lines 15-16 and 32-33).

Double Patenting

10. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct

from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., In re Berg, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); In re Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); In re Longi, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); In re Van Ornum, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and In re Thorington, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

11. Claims 1-4 and 9 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 6,689,262 B2. Although the conflicting claims are not identical, they are not patentably distinct from each other because the emitter of U.S. Patent No. 6,689,262 B2 is structurally the same as the emitter of the claimed flow-through oxygenator. Even though U.S. Patent No. 6,689,262 B2 does not explicitly teach the claimed flow through oxygenator, one of ordinary skill in the art would have found it obvious to use the instant emitter in an oxygenator as claimed since the emitter produces oxygen.

Response to Arguments

12. Applicant's arguments filed 9 November 2006 have been fully considered and are not persuasive.

In the remarks, applicant argues that oxygen microbubbles would not be formed, or if formed, would not persist, since the water electrolyzer of Divisek is operated at 300 to 600°C.

The examiner does not find applicant's argument persuasive since applicant's argument is not backed with evidence data demonstrating that the water electrolyzer of Divisek is not capable of producing oxygen microbubbles as claimed. Therefore, applicant's argument is merely considered as conclusive statement. In addition, the operating temperature of the claimed apparatus is directed to the manner in which the claimed apparatus is operated, wherefore does not lend patentability to the instant apparatus claims since it does not structurally distinguish the instant invention from the apparatus of Divisek. Furthermore, the examiner asserts that the water electrolyzer of Divisek is inherently capable of be operated at ambient temperature, which is the desirable operating temperature of the claimed apparatus.

Applicant further argues that the electrodes of the instant invention are not separated by a separator and are within an aqueous medium.

The examiner does not find applicant's argument persuasive since claim 1 is vague and indefinite for the same reasons as stated in paragraph 4 above. In addition, claim 1 uses open-ended transitional phrase "comprising" which allows the presence of additional structural elements such as the separator as taught by Divisek.

Terminal Disclaimer

13. In the remarks filed 9 November 2006, applicant alleges that a terminal disclaimer was filed to overcome the non-statutory obviousness-type double patenting rejection. However, the examiner does not find this terminal disclaimer on the record. Therefore, the non-statutory obviousness-type double patenting rejection is maintained until proper terminal disclaimer is filed.

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lois Zheng whose telephone number is (571) 272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

LLZ

FTW

PTO/SB/21 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission: 6

Application Number	10//732,326
Filing Date	12/10/2003
First Named Inventor	James Andrew Senkiw
Art Unit	1742
Examiner Name	Lois L. Zheng
Attorney Docket Number	AQI.002US1

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☒ Other Enclosure(s) (please Identify below):

Remarks

Post card

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature	Kathleen R. Terry		
Printed name	Kathleen R. Terry		
Date	November 6, 2006	Reg. No.	31,884

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Kathleen R. Terry		
Typed or printed name	Katheen R. Terry	Date	November 6, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	10/732,326
Applicant	James A. Senkiw.
Filed	12/10/2003
Art Unit	1742
Examiner	Lois L. Zheng

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE AND AMENDMENT
AMENDED FOR THE SECOND TIME

Dear Ms. Zheng:

Enclosed please find a response, amended for the second time, to the Office action of 11/29/2005, with a complete listing of claims presented in proper ascending order and with the proper status identifiers.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 4 of this paper.

Amendments to the Specification:

Please replace the ABSTRACT of this application with the following:

This application is a continuation-in-part of United States Patent Application Number 10/372,017, filed on February 21, 2003, now United States Patent Number 6,689,262, issued February 10, 2004, which claims priority to United States Provisional Patent Application Number 60/358,534, filed February 22, 2002.

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1. (Currently amended) A flow-through oxygenator comprising an emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, comprising an anode separated at a critical distance from a cathode within an aqueous medium, and a power source all in electrical communication with each other, wherein the emitter is placed within or adjacent to a conduit for flowing water.

Claim 2. (Currently amended) The emitter of claim 1 wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide ~~and the anode is platinum and iridium oxide on a support~~ and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 3. (Original) The critical distance of claim 1 which is 0.005 to 0.140 inches.

Claim 4. (Original) The critical distance of claim 1 which is 0.045 to 0.060 inches.

Claim 5. (Withdrawn) The product of claim 1 wherein the water is upersaturated with oxygen and of an approximately neutral pH.

Claim 6. (Withdrawn) A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

Claim 7. (Withdrawn) The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

Claim 8. (Withdrawn) A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

Claim 9. (New) The emitter of claim 1 wherein the anode is platinum and iridium oxide on a support and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

REMARKS/ARGUMENTS

The Examiner has rejected pending claims 1and 3 under U.S.C. § 102(b) as being anticipated by Divisek et al. US 4,225,401 ("Divisek"). Applicant respectfully disagrees.

In order to anticipate a claim, a reference must include each and every element or its equivalent, either explicitly or inherently. The claims as filed comprise the elements of "microbubbles," which would not be formed at the temperatures recited by Divisek, that is, 300° to 600° C (Divisek, column 3, line9), or if formed, would not persist. While not explicitly recited in the specification or claims, the present invention is designed to operate at ambient temperatures. (See for example, specification, Examples 5 and 6 on pages 11-15.)

Claim 1 has been amended to emphasize that unlike Divisek, the electrodes are not separated by a separator, but are within an aqueous medium. The substrate for electrolysis is emphasized to be an aqueous medium as well, to further distinguish the claims from Divisek. Divisek uses molten NaOH as an electrolyte with water vapor introduced as a substrate for electrolysis. (Divisek, column 4, line 56.) Applicant believes that claim 1 is now allowable.

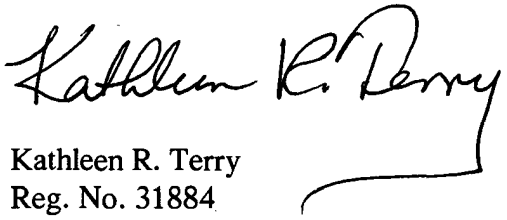
The Examiner has rejected claim 4 under U.S.C. §103 (a) as being obvious from Divisek. Divisek is actually silent as to the distance between electrodes. On column 3, lines 57-61, Divisek states that "distance between the electrodes which merely corresponds to the thickness of the separator are possible, in other words, for all practical purposes, this distance may amount to about 1-3 mm." While 1-3 mm overlaps with the critical distance recited in claim 4, claim 4 depends on claim 1 and includes all the elements of claim 1, since claim1 has now been distinguished from Divisek, it is submitted that the rejection is of claim 4 now longer applies.

The Examiner has rejected claim 2 under 35 U.S.C. § 103 (a) as being obvious from Divisek in view of Cairns et al U.S. 4,587,001. Claim 2 being dependant from claim 1, it should be read with all the elements of claim 1. New claim 5 has been added to delete the elements "platinum and iridium" from the claim 2 and present them in a new dependant claim. The invention to be operative is not dependant on any specific anodes and cathodes (specification, page 4, line 1-8) but the platinum and iridium electrodes are more durable and thence comprise the best mode of making the invention. Applicant believes that claim 2 and new claim 5 are now allowable.

The Examiner has rejected claim 1-4 on the ground of non-statutory obviousness-type double patenting over claims 1-6 of U.S. Patent 6,689,262B2. Applicant submits herewith a terminal disclaimer which obviates this rejection.

The claims being amended to more distinctly claim the invention and listing of the withdrawn claims added, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
Applicant James A. Senkiw, by his Attorney,



Kathleen R. Terry
Reg. No. 31884
(651) 659-9819
Krterry@visi.com

Please direct all correspondence to:
Kathleen R. Terry
1666 Coffman St. #314
Falcon Heights, MN 55108

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
10/732,326	12/10/2003	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY ☒ FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	11/09/2006	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 9	Minus	** 20	= 0	X $25 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X $100 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
catherine d. smith

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQ1.002US1	7020

7590 10/13/2006

Kathleen R. Terry
#314
1666 Coffman Street
Falcon Heights, MN 55108

EXAMINER	
ZHENG, LOIS L	
ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 10/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 10732326	Applicant(s)	
	Examiner	Art Unit	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

The amendment document filed on 4/25/06 is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☒ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☒ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☐ E. Other: Newly presented is not a status identifier

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714 and the USPTO website at http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/officeflyer.pdf .

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance. If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted within the time period set forth in the final Office action.
2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action.

Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

Failure to timely respond to this notice will result in:
Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Nicole Dunsley — Legal Instruments Examiner (LIE)

571-272-1026 — Telephone No.

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number: 10732326

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	8	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	8 minus 20=	*
INDEPENDENT CLAIMS	2 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT	☐	

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL	385	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A — 3/17/06

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 18	Minus	** 20	=
Independent	* 2	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=	—	OR	XS18=	—
X43=	—	OR	X86=	—
+145=	—	OR	+290=	—
TOTAL ADDIT. FEE	—	OR	TOTAL ADDIT. FEE	—

1 6

AMENDMENT B — 4/25/07

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

IFW

PTO/SB/122 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

CHANGE OF CORRESPONDENCE ADDRESS
Application

Address to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/732.326
Filing Date	12/10/2003
First Named Inventor	James Andrew Senkiw
Art Unit	1742
Examiner Name	Lois L. Zheng
Attorney Docket Number	AQI.002US1

Please change the Correspondence Address for the above-identified patent application to:

☐ The address associated with Customer Number: [ ]

OR

☐ Firm or Individual Name Kathleen R. Terry

Address 1666 Coffman Street #314

City	State	Zip
Falcon Heights	MN	55108

Country USA

Telephone	Email
651 659 9819	krterry@visi.com

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

I am the:

☐ Applicant/Inventor

☐ Assignee of record of the entire interest.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☑ Attorney or agent of record. Registration Number 31,884.

☐ Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number_____.

Signature Kathleen R. Terry

Typed or Printed Name Kathleen R. Terry

Date	Telephone
24 July 2006	651 659 9819

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 7 forms are submitted.

IFW

PTO/SB/21 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission: 7

Application Number	10/732,326
Filing Date	12/10/2003
First Named Inventor	James A. Senkiw
Art Unit	1742
Examiner Name	Lois L. Zhebg
Attorney Docket Number	AQI.002US

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☑ Other Enclosure(s) (please Identify below):

Remarks

Amended response with Notice of Non-Compliant Amendment

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature	Kathleen R. Terry		
Printed name	Kathleen R. Terry		
Date	19 April 2006	Reg. No.	31,884

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Kathleen R. Terry		
Typed or printed name	Kathleen R. Terry	Date	19 April 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	10/732,326
Applicant	James A. Senkiw.
Filed	12/10/2003
Art Unit	1742
Examiner	Lois L. Zheng

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDED RESPONSE AND AMENDMENT

Dear Ms. Zheng:

Enclosed please find an amended response to the Office action of 11/29/2005, with the claims presented in proper ascending order:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 4 of this paper.

Amendments to the Specification:

Please replace the ABSTRACT of this application with the following:

This application is a continuation-in-part of United States Patent Application Number 10/372,017, filed on February 21, 2003, now United States Patent Number 6,689,262, issued February 10, 2004, which claims priority to United States Provisional Patent Application Number 60/358,534, filed February 22, 2002.

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1. (Currently amended) A flow-through oxygenator comprising an emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, comprising an anode separated at a critical distance from a cathode within an aqueous medium, and a power source all in electrical communication with each other, wherein the emitter is placed within or adjacent to a conduit for flowing water.

Claim 2. (Currently amended) The emitter of claim 1 wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide ~~and the anode is platinum and iridium oxide on a support~~ and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 3. (Original) The critical distance of claim 1 which is 0.005 to 0.140 inches.

Claim 4. (Original) The critical distance of claim 1 which is 0.045 to 0.060 inches.

Claim 6. (Withdrawn) A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

Claim 7. (Withdrawn) The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

Claim 8. (Withdrawn) A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

Claim 9. (Newly presented) The emitter of claim 1 wherein the anode is platinum and iridium oxide on a support and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

REMARKS/ARGUMENTS

The Examiner has rejected pending claims 1and 3 under U.S.C. § 102(b) as being anticipated by Divisek et al. US 4,225,401 ("Divisek"). Applicant respectfully disagrees.

In order to anticipate a claim, a reference must include each and every element or its equivalent, either explicitly or inherently. The claims as filed comprise the elements of "microbubbles," which would not be formed at the temperatures recited by Divisek, that is, 300° to 600° C (Divisek, column 3, line9), or if formed, would not persist. While not explicitly recited in the specification or claims, the present invention is designed to operate at ambient temperatures. (See for example, specification, Examples 5 and 6 on pages 11-15.)

Claim 1 has been amended to emphasize that unlike Divisek, the electrodes are not separated by a separator, but are within an aqueous medium. The substrate for electrolysis is emphasized to be an aqueous medium as well, to further distinguish the claims from Divisek. Divisek uses molten NaOH as an electrolyte with water vapor introduced as a substrate for electrolysis. (Divisek, column 4, line 56.) Applicant believes that claim 1 is now allowable.

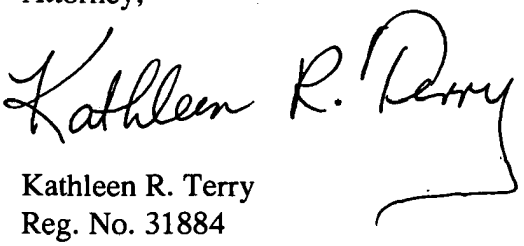
The Examiner has rejected claim 4 under U.S.C. §103 (a) as being obvious from Divisek. Divisek is actually silent as to the distance between electrodes. On column 3, lines 57-61, Divisek states that "distance between the electrodes which merely corresponds to the thickness of the separator are possible, in other words, for all practical purposes, this distance may amount to about 1-3 mm." While 1-3 mm overlaps with the critical distance recited in claim 4, claim 4 depends on claim 1 and includes all the elements of claim 1, since claim1 has now been distinguished from Divisek, it is submitted that the rejection is of claim 4 now longer applies.

The Examiner has rejected claim 2 under 35 U.S.C. § 103 (a) as being obvious from Divisek in view of Cairns et al U.S. 4,587,001. Claim 2 being dependant from claim 1, it should be read with all the elements of claim 1. New claim 5 has been added to delete the elements "platinum and iridium" from the claim 2 and present them in a new dependant claim. The invention to be operative is not dependant on any specific anodes and cathodes (specification, page 4, line 1-8) but the platinum and iridium electrodes are more durable and thence comprise the best mode of making the invention. Applicant believes that claim 2 and new claim 5 are now allowable.

The Examiner has rejected claim 1-4 on the ground of non-statutory obviousness-type double patenting over claims 1-6 of U.S. Patent 6,689,262B2. Applicant submits herewith a terminal disclaimer which obviates this rejection.

The claims being amended to more distinctly claim the invention and listing of the withdrawn claims added, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
Applicant James A. Senkiw, by his Attorney,



Kathleen R. Terry
Reg. No. 31884
(651) 659-9819
Krterry@visi.com

Please direct all correspondence to:
Kathleen R. Terry
2417 Como Avenue
St. Paul, MN 55108-1459

Notice of Non-Compliant Amendment (37 CFR 1.121)

Application No.	Applicant(s)	
10/732,326		
Examiner	**Art Unit**	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

The amendment document filed on _____ is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☒ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☒ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☐ E. Other: _____. claims 6, 7, 8 omitted, claim 5 st. identifier incorrect.
- ☐ 5. The amendment is unsigned or not signed in accordance with 37 CFR 1.4.

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714 and the USPTO website at http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/officeflyer.pdf .

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance. If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted within the time period set forth in the final Office action.
2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121 or 1.4, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action.

Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

Failure to timely respond to this notice will result in:

Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or

Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

A. Jordo — Legal Instruments Examiner (LIE)

(571) 272-1022 — Telephone No.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQL002US	7020

46350 7590 03/30/2006

KATHLEEN R. TERRY
2417 COMO AVENUE
ST. PAUL, MN 55108

EXAMINER	
ZHENG, LOIS L	

ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 03/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 10/732,326	Applicant(s)	
	Examiner	Art Unit	

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

The amendment document filed on _____ is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☒ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☒ E. Other: Claims 6, 7, 8 omitted, claim 5 st. identifier incorrect
- ☐ 5. The amendment is unsigned or not signed in accordance with 37 CFR 1.4.

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714 and the USPTO website at http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/officeflyer.pdf .

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance. If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted within the time period set forth in the final Office action.
2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121 or 1.4, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action.

Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.
Failure to timely respond to this notice will result in:
Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

L. Donlo — Legal Instruments Examiner (LIE)

(571) 272-1022 — Telephone No.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	10/732,326
Applicant	James A. Senkiw.
Filed	12/10/2003
Art Unit	1742
Examiner	Lois L. Zheng

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE AND AMENDMENT

Dear Ms. Zheng:

Enclosed please find a Request for Extension of Time. In response to the Office action of 11/29/2005, please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 4 of this paper.

Amendments to the Specification:

Please replace the ABSTRACT of this application with the following:

This application is a continuation-in-part of United States Patent Application Number 10/372,017, filed on February 21, 2003, now United States Patent Number 6,689,262, issued February 10, 2004, which claims priority to United States Provisional Patent Application Number 60/358,534, filed February 22, 2002.

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1. (Currently amended) A flow-through oxygenator comprising an emitter for electrolytic generation of microbubbles of oxygen from an aqueous medium, comprising an anode separated at a critical distance from a cathode within an aqueous medium, and a power source all in electrical communication with each other, wherein the emitter is placed within or adjacent to a conduit for flowing water.

Claim 2. (Currently amended) The emitter of claim 1 wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide ~~and the anode is platinum and iridium oxide on a support~~ and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 3. (Original) The critical distance of claim 1 which is 0.005 to 0.140 inches.

Claim 4. (Original) The critical distance of claim 1 which is 0.045 to 0.060 inches.

Claim 5. (Newly presented) The emitter of claim 1 wherein the anode is platinum and iridium oxide on a support and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

REMARKS/ARGUMENTS

The Examiner has rejected pending claims 1and 3 under U.S.C. § 102(b) as being anticipated by Divisek et al. US 4,225,401 ("Divisek"). Applicant respectfully disagrees.

In order to anticipate a claim, a reference must include each and every element or its equivalent, either explicitly or inherently. The claims as filed comprise the elements of "microbubbles," which would not be formed at the temperatures recited by Divisek, that is, 300° to 600° C (Divisek, column 3, line9), or if formed, would not persist. While not explicitly recited in the specification or claims, the present invention is designed to operate at ambient temperatures. (See for example, specification, Examples 5 and 6 on pages 11-15.)

Claim 1 has been amended to emphasize that unlike Divisek, the electrodes are not separated by a separator, but are within an aqueous medium. The substrate for electrolysis is emphasized to be an aqueous medium as well, to further distinguish the claims from Divisek. Divisek uses molten NaOH as an electrolyte with water vapor introduced as a substrate for electrolysis. (Divisek, column 4, line 56.) Applicant believes that claim 1 is now allowable.

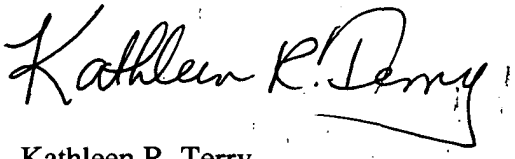
The Examiner has rejected claim 4 under U.S.C. §103 (a) as being obvious from Divisek. Divisek is actually silent as to the distance between electrodes. On column 3, lines 57-61, Divisek states that "distance between the electrodes which merely corresponds to the thickness of the separator are possible, in other words, for all practical purposes, this distance may amount to about 1-3 mm." While 1-3 mm overlaps with the critical distance recited in claim 4, claim 4 depends on claim 1 and includes all the elements of claim 1, since claim1 has now been distinguished from Divisek, it is submitted that the rejection is of claim 4 now longer applies.

The Examiner has rejected claim 2 under 35 U.S.C. § 103 (a) as being obvious from Divisek in view of Cairns et al U.S. 4,587,001. Claim 2 being dependant from claim 1, it should be read with all the elements of claim 1. New claim 5 has been added to delete the elements "platinum and iridium" from the claim 2 and present them in a new dependant claim. The invention to be operative is not dependant on any specific anodes and cathodes (specification, page 4, line 1-8) but the platinum and iridium electrodes are more durable and thence comprise the best mode of making the invention. Applicant believes that claim 2 and new claim 5 are now allowable.

The Examiner has rejected claim 1-4 on the ground of non-statutory obviousness-type double patenting over claims 1-6 of U.S. Patent 6,689,262B2. Applicant submits herewith a terminal disclaimer which obviates this rejection.

The claims being amended to more distinctly claim the invention, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
Applicant James A. Senkiw, by his Attorney,



Kathleen R. Terry
Reg. No. 31884
(651) 659-9819
Krterry@visi.com

Please direct all correspondence to:
Kathleen R. Terry
2417 Como Avenue
St. Paul, MN 55108-1459

PTO/SB/17 (01-06)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

For FY 2005 pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 125

Complete if Known	
Application Number	10/732,326
Filing Date	12/10/2003
First Named Inventor	James Andres Senkiw
Examiner Name	Lois L. Zheng
Art Unit	1742
Attorney Docket No.	AQI.002US1

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☐ Deposit Account Deposit Account Number: _____ Deposit Account Name: _____

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION (All the fees below are due upon filing or may be subject to a surcharge.)

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims	Fee ($)	Fee Paid ($)
_____	- 20 or HP =	_____	x _____	= _____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		Extra Claims	Fee ($)	Fee Paid ($)
_____	- 3 or HP =	_____	x _____	= _____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____ (round up to a whole number)	x _____	= _____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other (e.g., late filing surcharge): One-month extension; staturory disclaimer	$125

SUBMITTED BY

Signature	Kathleen R. Terry	Registration No. (Attorney/Agent) 31,884	Telephone 651 659 9819
Name (Print/Type)	Kathleen R. Terry		Date 15 mARCH 2006

PTO/SB/22 (12-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARMENT OF COMMERCE

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2005 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) AQT.002US1
Application Number 10/732,326	Filed 12/10/2003
For FLOW THROUGH OXYGENATOR	
Art Unit 1742	Examiner Lois L. Zheng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☑ One month (37 CFR 1.17(a)(1))	$120	$60	$ 60
☐ Two months (37 CFR 1.17(a)(2))	$450	$225	$
☐ Three months (37 CFR 1.17(a)(3))	$1020	$510	$
☐ Four months (37 CFR 1.17(a)(4))	$1590	$795	$
☐ Five months (37 CFR 1.17(a)(5))	$2160	$1080	$

☑ Applicant claims small entity status. See 37 CFR 1.27.

☑ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☐ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number _____. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 21,884

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____

Kathleen R. Ferry — Signature
15 March 2006 — Date
Kathleen R. Ferry — Typed or printed name
651 659 9819 — Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☑ Total of 1 forms are submitted.

JFW

PTO/SB/21 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission: 10

Application Number	10/732,326
Filing Date	12/10/2003
First Named Inventor	James Andrew Senkiw
Art Unit	1742
Examiner Name	Lois L. Zheng
Attorney Docket Number	AQI.002US1

ENCLOSURES (Check all that apply)

- [x] Fee Transmittal Form
- [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [x] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Remarks

Post card

The PTO did not receive the following listed item(s) Terminal Disclaimer

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature	Kathleen R. Terry		
Printed name	Kathleen R. Terry		
Date	15 March 2006	Reg. No.	31,884

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Kathleen R. Terry		
Typed or printed name	Kathleen R. Terry	Date	15 March 2006

KATHLEEN R. TERRY
2417 COMO AVENUE
SAINT PAUL, MN 55108

22-70/960

8772

15 March 20 06

PAY TO THE ORDER OF USPTO

$ 125.00

One hundred twenty-five and no/100 DOLLARS

SAINT ANTHONY PARK STATE BANK
2265 COMO AVE.
ST. PAUL, MN 55108
(651) 523-7800

FOR AQI.00245

Kathleen R. Terry

[redacted]

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number: 10732326

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	8	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	8 minus 20=	*
INDEPENDENT CLAIMS	2 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT	☐	

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL	385	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A — 3/17/06

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 18	Minus	** 20	= —
Independent	* 2	Minus	*** 3	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				— ☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=	—	OR	XS18=	—
X43=	—	OR	X86=	—
+145=	—	OR	+290=	—
TOTAL ADDIT. FEE	—	OR	TOTAL ADDIT. FEE	—

1 6

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,326	12/10/2003	James Andrew Senkiw	AQL002US	7020

46350 7590 11/29/2005

KATHLEEN R. TERRY
2417 COMO AVENUE
ST. PAUL, MN 55108

EXAMINER	
ZHENG, LOIS L	

ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 11/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	Lois Zheng	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

4a) Of the above claim(s) *5-8* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *19 July 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

   I. Claims 1-4, drawn to a flow-through oxygenator, classified in class 204, subclass 242.

   II. Claim 5, drawn to an oxygen supersaturated water product, classified in class 205, subclass 633.

   III. Claims 6-7, drawn to a method for enhancing growth of plants, classified in class 47, subclass 58.1 SC.

   IV. Claim 8, drawn to a method for treating waste water, classified in class 205, subclass 742.

2. Inventions I and II are related as apparatus and product made. The inventions in this relationship are distinct if either or both of the following can be shown: (1) that the apparatus as claimed is not an obvious apparatus for making the product and the apparatus can be used for making a different product or (2) that the product as claimed can be made by another and materially different apparatus (MPEP § 806.05(g)). In this case the oxygen supersaturated water can be made by another and materially different apparatus such as an non-electrochemical fluid aeration device.

3. Inventions III and I are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions have different function. Invention I is drawn to

an oxygenator apparatus while Invention III is drawn to a process for enhancing growth of plants.

4. Inventions IV and I are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus of Invention I can be used to practice another and materially difference process, such as a process to produce oxygen.

5. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

6. During a telephone conversation with Kathleen R. Terry on 15 November 2005 a provisional election was made without traverse to prosecute the invention of group I, claims 1-4. Affirmation of this election must be made by applicant in replying to this Office action. Claims 58 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1 and 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Divisek et al. US 4,225,401(Divisek).

Divisek teaches a water electrolyzer for generating hydrogen and oxygen(abstract). The water electrolyzer comprises and anode separated at a distance from a cathode(Fig. 1). Divisek further teaches that the distance between the electrodes is about 1-3 mm(col. 3 lines 54-61).

Regarding instant claims 1 and 3, since the water electrolyzer of Divisek produces oxygen, the claimed oxygen microbubbles is inherently electrolytically generated when Divisek's water electrolyzer is in operation. In addition, Divisek teaches the claimed anode and cathode separated about 1-3 mm apart from each other, which reads on the claimed critical distance as recited in instant claim 3. The claimed power source is also inherently present in the water electrolyzer of Divisek. Fig. 1 of Divisek further shows that the water electrolyzer is placed within a conduit for flowing water Therefore, the water electrolyzer of Divisek meets the structural limitation of the instant claims 1 and 3. The examiner concludes that the electrolyzer of Divisek reads on the claimed flow-through oxygenator and the claimed emitter based on the broadest reasonable interpretation.

Therefore, Divisek anticipates instant claims 1 and 3.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek.

The teachings of Divisek are discussed in paragraph 8 above.

Regarding instant claim 4, the distance of 1-3mm between the electrodes as taught by Divisek encompasses the claimed critical distance of 0.045 to 0.060 inches.

Therefore, a prima facie case of obviousness exists. See MPEP 2144.05. The selection of claimed critical distance from the disclosed range of Divisek would have been obvious to one skilled in the art since Divisek teaches the same utilities in its' disclosed critical distance range.

11. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Divisek in view of Cairns et al. US 4,587,001(Cairns).

The teachings of Divisek are discussed in paragraph 8 above. Divisek further teaches that the anode and the cathode are made of nickel(col. 4 lines 37-39).

However, Divisek does not explicitly teach the claimed anode being platinum and iridium oxide on a support.

Cairns teaches an cathode for use in an electrolytic cell(abstract). Cairns further teaches an titanium anode having a electro-catalytically active coating material comprising one or more oxides of platinum group metals such as platinum and iridium(col. 5 lines 15-25).

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the anode of Cairns into the electrolyzer of Divisek as the anode since Cairns teaches that platinum group metal oxides is a good electro-catalytically active

material for an anode of an electrolytic cell and the application of such coating on an anode is well known in the art(col. 5 lines 15-16 and 32-33).

Double Patenting

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., In re Berg, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); In re Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); In re Longi, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); In re Van Ornum, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and In re Thorington, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

13. Claims 1-4 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 6,689,262 B2. Although the conflicting claims are not identical, they are not patentably distinct from each other because the emitter of U.S. Patent No. 6,689,262 B2 is structurally the same as the emitter of the claimed flow-through oxygenator. Even though U.S. Patent No. 6,689,262 B2 does not explicitly teach the claimed flow through oxygenator, one of ordinary skill in the art would have found it obvious to use the instant emitter in an oxygenator as claimed since the emitter produces oxygen.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lois Zheng whose telephone number is (571) 272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

LLZ

PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	10/732,326
Filing Date	December 10. 2003
First Named Inventor	James Andrew Senkiw
Art Unit	1742
Examiner Name	
Attorney Docket Number	AQI.002US1

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 6,689,262	02-10-2004	Senkiw	
		US- 6,394,429	05-28-2002	Gvzn - Calvo	
		US- 6,315,886B1	11-13-2001	Zappi et al.	
		US- 5,982,609	11-09-1999	Evans	
		US- 5,534,143	07-09-1986	Portier et al.	
		US- 4,252,856	02-24-1981	Sarz	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	11/21/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08B (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	2	of	2

Complete if Known	
Application Number	10/732,326
Filing Date	December 10, 2003
First Named Inventor	James Andrew Senkiw
Art Unit	
Examiner Name	
Attorney Docket Number	AQI.002US1

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
DD		Effect of Oxygenated Water on the Growth and Biomass Development of Seedless Cucumbers and Tomato Seedlings under Greenhouse Conditions: Mohyuddin Mirza et al. www.seair.ca	

Examiner Signature		Date Considered	11/21/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Notice of References Cited	Application/Control No. 10/732,326	Applicant(s)/Patent Under Reexamination SENKIW, JAMES ANDREW	
	Examiner Lois Zheng	Art Unit 1742	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,225,401	09-1980	Divisek et al.	205/354
*	B	US-4,587,001	05-1986	Cairns et al.	204/290.14
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 7020

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/732,326	12/10/2003 RULE	204	1742	AQL002US

APPLICANTS

James Andrew Senkiw, Minneapolis, MN;

** CONTINUING DATA **********

This application is a CIP of 10/372,017 02/21/2003 PAT 6,689,262
which claims benefit of 60/358,534 02/22/2002

** FOREIGN APPLICATIONS **********

None

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 03/17/2004

Foreign Priority claimed	STATE OR	SHEETS	TOTAL	INDEPENDENT
☐ yes ☒ no	COUNTRY	DRAWING	CLAIMS	CLAIMS
35 USC 119 (a-d) conditions met ☐ yes ☒ no ☐ Met after Allowance	MN	8	8	2
Verified and Acknowledged Examiner's Signature Initials				

ADDRESS
46350
KATHLEEN R. TERRY
2417 COMO AVENUE
ST. PAUL , MN
55108

TITLE
Flow-through oxygenator

FILING FEE	FEES: Authority has been given in Paper	☐ All Fees
RECEIVED	No. _____ to charge/credit DEPOSIT ACCOUNT	☐ 1.16 Fees (Filing)
385	No. _____ for following:	☐ 1.17 Fees (Processing Ext. of time)
		☐ 1.18 Fees (Issue)
		☐ Other _____
		☐ Credit

Exhibit 1008_0259

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/732,326	SENKIW, JAMES ANDREW	
	Examiner	Art Unit	
	Lois Zheng	1742	

SEARCHED			
Class	Subclass	Date	Examiner
205	628-639	11/21/2005	LLZ
204	242	11/21/2005	LLZ
204	245	11/21/2005	LLZ
204	275.1	11/21/2005	LLZ
204	278.5	11/21/2005	LLZ
204	290.1	11/21/2005	LLZ

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Inventorship search	11/14/2005	LLZ
See Attached EAST Search	11/21/2005	LLZ

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	204	(205/633-636).ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/14 09:36
S2	3	S1 and microbubbles	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/14 09:37
S3	0	S1 and micro adj bubbles	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/14 09:37
S4	3	S1 and critical distance	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2005/11/14 09:38
S5	2	"6689262".pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/14 09:39
S6	10	("3975269" | "4012319" | "4732661" | "4908109" | "5049252" | "5182014" | "5534143" | "6315886" | "6394429" | "6471873" | "WO 9521795").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 09:46
S7	7813	anode with cathode with distance	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 09:46
S8	140	S7 and water adj (electrolyz$4 or electrolysis)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 09:47
S9	105	S7 and water adj (electrolyz$4 or electrolysis) and oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 09:47
S11	76	S9 and distance with (inch or in or micrometer or micron or "mu.m" or millimeter or mm or centimeter or cm)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 10:07

S12	7813	anode with cathode with distance	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 12:46
S13	105	S12 and water adj (electrolyz$4 or electrolysis) and oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/14 12:46
S14	76	S13 and distance with (inch or in or micrometer or micron or "mu. m" or millimeter or mm or centimeter or cm)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:53
S15	8	S14 and anode with (platnium or Pt or iridium or Ir) with oxide	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:27
S16	13	(growth or yield) with plants and (supersaturated or (super adj saturated)) adj water	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 15:29
S17	1	"5887383".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/15 09:26
S18	1	"6004450".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/15 09:27
S19	3230	oxygenator	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:34
S20	279	S19 and (oxygen or "O.sub.2") near5 (bubbles or microbubbles)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:35
S21	40	S20 and (electrode or anode or cathode)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:35
S23	22	S21 and distance with (inch or in or micrometer or micron or "mu. m" or millimeter or mm or centimeter or cm)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:34
S24	1253	oxygenator	EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 10:35
S25	0	S24 and (oxygen or "O.sub.2") near5 (bubbles or microbubbles)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:35
S26	0	S24 and (electrode or anode or cathode)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:35

S27	204	(205/633-636).ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 10:49
S28	18	(205/633-636).ccls. and bubbles with oxygen	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 10:49
S29	7824	anode with cathode with distance	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 10:53
S30	105	S29 and water adj (electrolyz$4 or electrolysis) and oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 14:07
S31	76	S30 and distance with (inch or in or micrometer or micron or "mu. m" or millimeter or mm or centimeter or cm)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 14:07
S32	6	("4252856"|"5534143"|"5982609" |"6315886"|"6394429"|"6689262").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 11:13
S35	1	"4048047".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 11:13
S37	860	(205/628-639).ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 14:06
S38	350	S37 and water near3 (electrolyz$4 or electrolysis) and oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 14:07
S39	40	S38 and distance with (inch or in or micrometer or micron or "mu. m" or millimeter or mm or centimeter or cm)	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 15:06
S40	10	("3975269" | "4012319" | "4732661" | "4908109" | "5049252" | "5182014" | "5534143" | "6315886" | "6394429" | "6471873" | "WO 9521795").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 14:14
S42	187	supersaturated adj water	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 15:06

S43	19	supersaturated adj water with oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/22 09:53
S44	4	(growth or yield) with plants and (supersaturated or (super adj saturated)) with water with oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 15:24
S45	28302	(growth or yield) with plants and (method or process).clm.	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 15:29
S46	47	(growth or yield) with plants and (method or process).clm. and (saturated or supersaturated) near2 oxygen	US-PGPUB; USPAT; USOCR	OR	ON	2005/11/21 15:30
S47	140	(water adj electroly$4) and anode same (platinum with iridium with oxide)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 18:13
S48	146	(water adj electroly$4) and anode same (platinum with iridium with (oxide or dioxide))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 18:53
S49	3	"3775284".pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 18:33
S50	4	"4100049".pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 18:47
S51	79	anode same (platinum with iridium with (oxide or dioxide)) same support	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 18:54

IFW

S/N 10/732,326 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: James Andrew Senkiw
Serial Number: 10/732,326
Title: Flow-Through Oxygenator
Filing Date: December 10, 2003

Examiner: Not assigned
Group art unit: Not assigned
Att'y No.: AQI.002US1

MS PATENT APPLICATION
Assistant Commissioner for Patents
Box 1450
Alexandria, VA, 22313-1450

In compliance with the duty imposed by 37 C.F.R.§1.50 and in accordance with C.F.R.§§ 1.97 *et seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached form 1449 be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant further requests that a copy of the 1449 form, initialed by the Examiner to indicate that all listed citations have been considered, be returned with the next official communication.

Under C.F.R.§1,97 (b)(3), it is believed that no fee or certificate is required with this Information Disclosure Statement. If an official action has been mailed, the required fee will be paid. The Examiner is invited to contact the Applicant's representative at the below listed telephone number or e-mail address if there are any questions regarding this communication.

Respectfully submitted,

James Andrew Senkiw
By his representative,

Kathleen R. Terry 15 July 2004
Kathleen R. Terry Date
Reg. No. 31884

2417 Como Avenue
St. Paul, MN 55108-1459
651 659 9819
Krterry@visi.com

I hereby certify that these papers are being deposited with the USPS Service with sufficient first class postage and addressed to MS Patent Application, Commissioner for Patents, Box 1450, Alexandria, VA 22313-1450 on the date noted above.

PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	10/732,326
Filing Date	December 10. 2003
First Named Inventor	James Andrew Senkiw
Art Unit	
Examiner Name	
Attorney Docket Number	AQI.002US1

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 6,689,262	02-10-2004	Senkiw	
		US- 6,394,429	05-28-2002	Guan - Calva	
		US- 6,315,886B1	11-13-2001	Zappi et al.	
		US- 5,982,609	11-09-1999	Evans	
		US- 5,534,143	07-09-1986	Pardier et al.	
		US- 4,252,856	03-24-1981	Sarz	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08B (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

	Complete If Known
Application Number	10/732,326
Filing Date	December 10, 2003
First Named Inventor	James Andrew Senkiw
Art Unit	
Examiner Name	
Attorney Docket Number	AQI.002US1

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Effect of Oxygenated Water on the Growth and Biomass Development of Seedless Cucumbers and Tomato Seedlings under Greenhouse Conditions: Mohyuddin Mirza et al. www.seair.ca	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

PTO/SB/05 (08-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	AQI.002US1
First Inventor	James Andrew Sonkiw
Title	FLOW-THROUGH OXYGENATOR
Express Mail Label No.	EV840782744US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Mail Stop Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

17497 U.S.PTO
10/732326
121003

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification [*Total Pages* 17]
(preferred arrangement set forth below)
- Descriptive title of the invention
- Cross Reference to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to sequence listing, a table, or a computer program listing appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings *(if filed)*
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

4. ☒ Drawing(s) (*35 U.S.C. 113*) [*Total Sheets* 8]
5. Oath or Declaration [*Total Sheets* 2]
a. ☒ Newly executed (original or copy)
b. ☐ Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 18 completed)
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ Application Data Sheet. See 37 CFR 1.76
7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program *(Appendix)*
8. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. ☐ Computer Readable Form (CRF)
b. Specification Sequence Listing on:
i. ☐ CD-ROM or CD-R (2 copies); or
ii. ☐ Paper
c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement *(when there is an assignee)* ☐ Power of Attorney
11. ☐ English Translation Document *(if applicable)*
12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☐ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
16. ☐ Nonpublication Request under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
17. ☐ Other: .....

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

☐ Continuation ☐ Divisional ☒ Continuation-in-part (CIP) of prior application No.: 10/372,017

Prior application information: *Examiner* Bruce Bell *Art Unit:* 1746

For CONTINUATION OF DIVISIONAL APPS only; The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

19. CORRESPONDENCE ADDRESS

☐ Customer Number: ☒ OR ☒ Correspondence address below

Name	Kathleen R. Terry				
Address	2417 Como Ave				
City	St. Paul	*State*	MN	*Zip Code*	55108-1459
Country	USA	*Telephone*	651 659	*Fax*	651 603 5609

Name (Print/Type)	Kathleen R. Terry	*Registration No. (Attorney/Agent)*	31 884
Signature	Kathleen R. Terry	*Date*	10 Dec. 2003

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop Patent Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

22763 U.S. PTO
121003

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($)

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	
Examiner Name	
Art Unit	
Attorney Docket No.	

METHOD OF PAYMENT *(check all that apply)*

☒ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account:

Deposit Account Number
Deposit Account Name

The Director is authorized to: *(check all that apply)*

☐ Charge fee(s) indicated below ☐ Credit any overpayments

☐ Charge any additional fee(s) or any underpayment of fee(s)

☐ Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	385
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($) 385

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

	Extra Claims		Fee from below	Fee Paid
Total Claims	8	-20** = 0	X	= 0
Independent Claims	3	- 3** = 0	X	= 0
Multiple Dependent			0	= 0

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 385

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($)

SUBMITTED BY				(Complete *(if applicable)*)	
Name (Print/Type)	Kathleen R Terry	Registration No. (Attorney/Agent)	31 884	Telephone	651 659 9819
Signature	Kathleen R Terry			Date	10 Dec. 2003

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

This collection of information is required by 37 CFR 1.17 and 1.27. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

FLOW-THROUGH OXYGENATOR

RELATED APPLICATIONS

This application is a continuation-in-part of United States Patent Application Number 10/872,017, now United States Patent Number 6,xxx,xxx, which claims priority to United States Provisional Patent Application Number 60/358,534, filed February 22, 2002.

FIELD OF THE INVENTION

This invention relates to the electrolytic generation of microbubbles of oxygen for increasing the oxygen content of flowing water. This invention also relates to the use of superoxygenated water to enhance the growth and yield of plants. The flow-through model is useful for oxygenating water for hydroponic plant culture, drip irrigation and waste water treatment.

BACKGROUND OF THE INVENTION

Many benefits may be obtained through raising the oxygen content of aqueous media. Efforts have been made to achieve higher saturated or supersaturated oxygen levels for applications such as the improvement of water quality in ponds, lakes, marshes and reservoirs, the detoxification of contaminated water, culture of fish, shrimp and other aquatic animals, biological culture and hydroponic culture. For example, fish held in a limited environment such as an aquarium, a bait bucket or a live hold tank may quickly use up the dissolved oxygen in the course of normal respiration and are then subject to hypoxic stress, which can lead to death. A similar effect is seen in cell cultures, where the respiring cells would benefit from higher oxygen content of the medium. Organic pollutants from agricultural, municipal and industrial facilities spread through the ground and surface water and adversely affect life forms. Many pollutants are toxic, carcinogenic or mutagenic. Decomposition of these pollutants is facilitated by oxygen, both by direct chemical detoxifying reactions or by stimulating the growth of detoxifying microflora. Contaminated water is described as having an increased biological oxygen demand (BOD) and water treatment is aimed at decreasing the BOD so as to make more oxygen available for fish and other life forms.

The most common method of increasing the oxygen content of a medium is by sparging with air or oxygen. While this is a simple method, the resulting large bubbles produced simply break the surface and are discharged into the atmosphere. Attempts have been made to reduce the size of the bubbles in order to facilitate oxygen transfer by increasing the total surface area of the oxygen bubbles. United States Patent Number 5,534,143 discloses a microbubble generator that achieves a bubble size of about 0.10 millimeters to about 3 millimeters in diameter. United States Patent Number 6,394,429 ("the '429 patent") discloses a device for producing microbubbles, ranging in size from 0.1 to 100 microns in diameter, by forcing air into the fluid at high pressure through a small orifice.

When the object of generating bubbles is to oxygenate the water, either air, with an oxygen content of about 21%, or pure oxygen may be used. The production of oxygen and hydrogen by the electrolysis of water is well known. A current is applied across an anode and a cathode which are immersed in an aqueous medium. The current may be a direct current from a battery or an AC/DC converter from a line. Hydrogen gas is produced at the cathode and oxygen gas is produced at the anode. The reactions are:

AT THE CATHODE: $4H_2O + 4\ e^- \rightarrow 4OH^- + 2H_2$

AT THE ANODE: $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

NET REACTION: $6H_2O \rightarrow 4OH^- + 4H^+ + 2H_2 + O_2$

286 kilojoules of energy is required to generate one mole of oxygen.

The gasses form bubbles which rise to the surface of the fluid and may be collected. Either the oxygen or the hydrogen may be collected for various uses. The "electrolytic water" surrounding the anode becomes acidic while the electrolytic water surrounding the cathode becomes basic. Therefore, the electrodes tend to foul or pit and have a limited life in these corrosive environments.

Many cathodes and anodes are commercially available. United States Patent Number 5,982,609 discloses cathodes comprising a metal or metallic oxide of at least one metal selected from the group consisting of ruthenium, iridium, nickel, iron, rhodium, rhenium, cobalt, tungsten,

manganese, tantalum, molybdenum, lead, titanium, platinum, palladium and osmium. Anodes are formed from the same metallic oxides or metals as cathodes. Electrodes may also be formed from alloys of the above metals or metals and oxides co-deposited on a substrate. The cathode and anodes may be formed on any convenient support in any desired shape or size. It is possible to use the same materials or different materials for both electrodes. The choice is determined according to the uses. Platinum and iron alloys ("stainless steel") are often preferred materials due to their inherent resistance to the corrosive electrolytic water. An especially preferred anode disclosed in U. S. Patent Number 4,252,856 comprises vacuum deposited iridium oxide.

Holding vessels for live animals generally have a high population of animals which use up the available oxygen rapidly. Pumps to supply oxygen have high power requirements and the noise and bubbling may further stress the animals. The available electrolytic generators likewise have high power requirements and additionally run at high voltages and produce acidic and basic water which are detrimental to live animals. Many of the uses of oxygenators, such as keeping bait or caught fish alive, would benefit from portable devices that did not require a source of high power. The need remains for quiet, portable, low voltage means to oxygenate water.

It has also been known that plant roots are healthier when oxygenated water is applied. It is thought that oxygen inhibits the growth of deleterious fungi. The water sparged with air as in the '429 patent was shown to increase the biomass of hydroponically grown cucumbers and tomatoes by about 15%.

The need remains for oxygenator models suitable to be placed in-line in water distribution devices so as to be applied to field as well as hydroponic culture.

SUMMARY OF THE INVENTION

This invention provides an oxygen emitter which is an electrolytic cell which generates very small microbubbles and nanobubbles of oxygen in an aqueous medium, which bubbles are too small to break the surface tension of the medium, resulting in a medium supersaturated with oxygen.

The electrodes may be a metal or oxide of at least one metal selected from the group consisting of ruthenium, iridium, nickel, iron, rhodium, rhenium, cobalt, tungsten, manganese, tantalum, molybdenum, lead, titanium, platinum, palladium and osmium or oxides thereof. The electrodes may be formed into open grids or may be closed surfaces. The most preferred cathode is a stainless steel mesh. The most preferred mesh is a 1/16 inch grid. The most preferred anode is platinum and iridium oxide on a support. A preferred support is titanium.

In order to form microbubbles and nanobubbles, the anode and cathode are separated by a critical distance. The critical distance ranges from 0.005 inches to 0.140 inches. The preferred critical distance is from 0.045 to 0.060 inches.

Models of different size are provided to be applicable to various volumes of aqueous medium to be oxygenated. The public is directed to choose the applicable model based on volume and power requirements of projected use. Those models with low voltage requirements are especially suited to oxygenating water in which animals are to be held.

Controls are provided to regulate the current and timing of electrolysis.

A flow-through model is provided which may be connected in-line to a watering hose or to a hydroponic circulating system. The flow-through model can be formed into a tube with triangular cross-section. In this model, the anode is placed toward the outside of the tube and the cathode is placed on the inside, contacting the water flow. Alternatively, the anodes and cathodes may be in plates parallel to the long axis of the tube, or may be plates in a wafer stack. Alternately, the electrodes may be placed in a side tube ("T" model) out of the direct flow of water. Protocols are provided to produce superoxygenated water at the desired flow rate and at the desired power usage. Controls are inserted to activate electrolysis when water is flowing and deactivate electrolysis at rest.

This invention includes a method to promote growth and increase yield of plants by application of superoxygenated water. The water treated with the emitter of this invention is one example of

superoxygenated water. Plants may be grown in hydroponic culture or in soil. The use of the flow-through model for drip irrigation of crops and waste water treatment is disclosed.

DESCRIPTION OF THE DRAWINGS

Figure 1 is the O_2 emitter of the invention.

Figure 2 is an assembled device.

Figure 3 is a diagram of the electronic controls of the O_2 emitter.

Figure 4 shows a funnel or pyramid variation of the O_2 emitter.

Figure 5 shows a multilayer sandwich O_2 emitter.

Figure 6 shows the yield of tomato plants watered with superoxygenated water.

Figure 7 shows an oxygenation chamber suitable for flow-through applications. Figure 7A is a cross section showing arrangement of three plate electrodes. Figure 7B is a longitudinal section showing the points of connection to the power source.

Figure 8 is a graph showing the oxygenation of waste water.

DETAILED DESCRIPTION OF THE INVENTION

Definitions:

For the purpose of describing the present invention, the following terms have these meanings:

"Critical distance" means the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.

"Critical distance" means the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.

"O_2 emitter" means a cell comprised of at least one anode and at least one cathode separated by the critical distance.

"Metal" means a metal or an alloy of one or more metals.

"Microbubble" means a bubble with a diameter less than 50 microns.

"Nanobubble" means a bubble with a diameter less than that necessary to break the surface tension of water. Nanobubbles remain suspended in the water, giving the water an opalescent or milky appearance.

"Supersaturated" means oxygen at a higher concentration than normal calculated oxygen solubility at a particular temperature and pressure.

"Superoxygenated water" means water with an oxygen content at least 120% of that calculated to be saturated at a temperature.

"Water" means any aqueous medium with resistance less than one ohm per square centimeter; that is, a medium that can support the electrolysis of water. In general, the lower limit of resistance for a medium that can support electrolysis is water containing more than 2000 ppm total dissolved solids.

The present invention produces microbubbles and nanobubbles of oxygen via the electrolysis of water. As molecular oxygen radical (atomic weight 8) is produced, it reacts to form molecular oxygen, O_2. In the special dimensions of the invention, as explained in more detail in the following examples, O_2 forms bubbles which are too small to break the surface tension of the fluid. These bubbles remain suspended indefinitely in the fluid and, when allowed to build up, make the fluid opalescent or milky. Only after several hours do the bubbles begin to coalesce on

the sides of the container and the water clears. During that time, the water is supersaturated with oxygen. In contrast, the H_2 formed readily coalesces into larger bubbles which are discharged into the atmosphere, as can be seen by bubble formation at the cathode.

The first objective of this invention was to make an oxygen emitter with low power demands, low voltage and low current for use with live animals. For that reason, a small button emitter was devised. The anode and cathode were set at varying distances. It was found that electrolysis took place at very short distances before arcing of the current occurred. Surprisingly, at slightly larger distances, the water became milky and no bubbles formed at the anode, while hydrogen continued to be bubbled off the cathode. At distance of 0.140 inches between the anode and cathode, it was observed that the oxygen formed bubbles at the anode. Therefore, the critical distance for microbubble and nanobubble formation was determined to be between 0.005 inches and 0.140 inches.

Example 1. Oxygen emitter.

As shown in Figure 1, the oxygen evolving anode 1 selected as the most efficient is an iridium oxide coated single sided sheet of platinum on a support of titanium (Eltech, Fairport Harbor, OH). The cathode 2 is a 1/16 inch mesh (size 8 mesh) marine stainless steel screen. The anode and cathode are separated by a non-conducting spacer 3 containing a gap 4 for the passage of gas and mixing of anodic and cathodic water and connected to a power source through a connection point 5. Figure 2 shows a plan view of the assembled device. The O_2 emitter 6 with the anode connecting wire 7 and the cathode connecting wire 8 is contained in an enclosure 9, connected to the battery compartment 10. The spacer thickness is critical as it sets the critical distance. It must be of sufficient thickness to prevent arcing of the current, but thin enough to separate the electrodes by no more than 0.140 inches. Above that thickness, the power needs are higher and the oxygen bubbles formed at higher voltage will coalesce and escape the fluid. Preferably, the spacer is from 0.005 to 0.075 inches thick. At the lower limits, the emitter tends to foul more quickly. Most preferably, the spacer is about 0.050 inches thick. The spacer may be any nonconductive material such as nylon, fiberglass, Teflon® polymer or other plastic. Because of the criticality of the space distance, it is preferable to have a non-compressible spacer. It was found that Buna, with a durometer measure of 60 was not acceptable due to

decomposition. Viton, a common fluoroelastomer, has a durometer measure of 90 and was found to hold its shape well.

In operation, a small device with an O_2 emitter 1.485 inches in diameter was driven by 4AA batteries. The critical distance was held at 0.050 inches with a Viton spacer. Five gallons of water became saturated in seven minutes. This size is suitable for raising oxygen levels in an aquarium or bait bucket.

It is convenient to attach a control circuit which comprises a timer that is thermostatically controlled by a temperature sensor which determines the off time for the cathode. When the temperature of the solution changes, the resistance of the thermistor changes, which causes an off time of a certain duration. In cool water, the duration is longer so in a given volume, the emitter generates less oxygen. When the water is warmer and therefore hold less oxygen, the duration of off time is shorter. Thus the device is self-controlled to use power most economically. Figure 3 shows a block diagram of a timer control with anode 1, cathode 2, thermistor temperature sensor 3, timer control circuit 4 and wire from a direct current power source 5.

Example 2. Measurement of O_2 bubbles.

Attempts were made to measure the diameter of the O_2 bubbles emitted by the device of Example 1. In the case of particles other than gasses, measurements can easily be made by scanning electron microscopy, but gasses do not survive electron microscopy. Large bubble may be measured by pore exclusion, for example, which is also not feasible when measuring a gas bubble. A black and white digital, high contrast, backlit photograph of treated water with a millimeter scale reference was shot of water produced by the emitter of Example 1. About 125 bubbles were seen in the area selected for measurement. Seven bubbles ranging from the smallest clearly seen to the largest were measured. The area was enlarged, giving a scale multiplier of 0.029412.

Recorded bubble diameters at scale were 0.16, 0.22, 0.35, 0.51, 0.76, 0.88 and 1.09 millimeters. The last three were considered outliers by reverse analysis of variance and were assumed to be

hydrogen bubbles. When multiplied by the scale multiplier, the assumed O_2 bubbles were found to range from 4.7 to 15 microns in diameter. This test was limited by the resolution of the camera and smaller bubbles in the nanometer range could not be resolved. It is known that white light cannot resolve features in the nanometer size range, so monochromatic laser light may give resolution sensitive enough to measure smaller bubbles. Efforts continue to increase the sensitivity of measurement so that sub-micron diameter bubbles can be measured.

Example 3. Other models of oxygen emitter

Depending on the volume of fluid to be oxygenated, the oxygen emitter of this invention may be shaped as a circle, rectangle, cone or other model. One or more may be set in a substrate that may be metal, glass, plastic or other material. The substrate is not critical as long as the current is isolated to the electrodes by the nonconductor spacer material of a thickness from 0.005 to 0.075 inches, preferably 0.050 inches. It has been noticed that the flow of water seems to be at the periphery of the emitter, while the evolved visible bubbles (H_2) arise at the center of the emitter. Therefore, a funnel or pyramidal shaped emitter was constructed to treat larger volumes of fluid. Figure 4 is a cross sectional diagram of such an emitter. The anode 1 is formed as an open grid separated from a marine grade stainless steel screen cathode 2 by the critical distance by spacer 3 around the periphery of the emitter and at the apex. This flow-through embodiment is suitable for treating large volumes of water rapidly.

The size may be varied as required. A round emitter for oxygenating a bait bucket may be about 2 inches in diameter, while a 3-inch diameter emitter is adequate for oxygenating a 10 to 40 gallon tank. The live well of a fishing boat will generally hold 40 to 80 gallons of water and require a 4-inch diameter emitter. It is within the scope of this invention to construct larger emitters or to use several in a series to oxygenate larger volumes. It is also within the scope of this invention to vary the model to provide for low voltage and amperage in cases where the need for oxygen is moderate and long lasting or conversely, to supersaturate water very quickly at higher voltage and amperage. In the special dimensions of the present invention, it has been found that a 6 volt battery supplying a current as low as 40 milliamperes is sufficient to generate oxygen. Such a model is especially useful with live plants or animals, while it is more convenient for industrial use to use a higher voltage and current. Table I shows a number of

models suitable to various uses.

TABLE I

Emitter Model	Gallons	Volts	Amps Max.	Ave	Watts
Bait keeper	5	6	0.090	0.060	0.36
Livewell	32	12	0.180	0.120	1.44
OEM 2 inch	10	12	0.210	0.120	1.44
Bait store	70	12	0.180	0.180	2.16
Double cycle	2	12	0.180	0.180	2.16
OEM 3 inch	50	12	0.500	0.265	3.48
OEM 4 inch	80	12	0.980	0.410	4.92
Water pail	2	24	1.200	1.200	28.80
Plate	250	12	5.000	2.500	30.00

Example 4. Multilayer sandwich O_2 emitter

An O_2 emitter was made in a multilayer sandwich embodiment. (Figure 5) An iridium oxide coated platinum anode 1 was formed into a grid to allow good water flow and sandwiched between two stainless steel screen cathodes 2. Spacing was held at the critical distance by nylon spacers 3. The embodiment illustrated is held in a cassette 4 which is secured by nylon bolt 5 with a nylon washer 6. The dimensions selected were:

cathode screen 0.045 inches thick
nylon spacer 0.053 inches thick
anode grid 0.035 inches thick
nylon spacer 0.053 inches thick
cathode screen 0.045 inches thick,

for an overall emitter thickness of 0.231 inches.

If a more powerful emitter is desired, it is within the scope of this invention to repeat the sequence of stacking. For example, an embodiment may easily be constructed with this sequence: cathode, spacer, anode, spacer, cathode, spacer, anode, spacer, cathode, spacer, anode, spacer, cathode. The number of layers in the sandwich is limited only by the power requirements acceptable for an application.

Example 5. Effect of superoxygenated water on the growth of plants.

It is known that oxygen is important for the growth of plants. Although plants evolve oxygen during photosynthesis, they also have a requirement for oxygen for respiration. Oxygen is evolved in the leaves of the plants, while often the roots are in a hypoxic environment without enough oxygen to support optimum respiration, which can be reflected in less than optimum growth and nutrient utilization. Hydroponically grown plants are particularly susceptible to oxygen deficit in the root system. United States Patent Number 5,887,383 describes a liquid supply pump unit for hydroponic cultures which attain oxygen enrichment by sparging with air. Such a method has high energy requirements and is noisy. Furthermore, while suitable for self-contained hydroponic culture, the apparatus is not usable for field irrigation. In a report available on the web, it was shown that hydroponically grown cucumbers and tomatoes supplied with water oxygenated with a device similar to that described in the '429 patent had increased biomass of about 12% and 17% respectively. It should be noted that when sparged with air, the water may become saturated with oxygen, but it is unlikely that the water is superoxygenated.

A. Superoxygenated water in hydroponic culture.

Two small hydroponic systems were set up to grow two tomato plants. Circulation protocols were identical except that the 2 ½ gallon water reservoir for the Control plant was eroated with and aquarium bubbler and that for the Test plant was oxygenated with a five-inch strip emitter for two minutes prior to pumping. The cycle was set at four minutes of pumping, followed by four minutes of rest. The control water had an oxygen content of about 97% to 103% saturation, that is, it was saturated with oxygen. The test water had an oxygen content of about 153% to165% saturation, that is, it was supersaturated. The test plant was at least four times the volume of the control plant and began to show what looked like fertilizer burn. At that point the fertilizer for the Test plant was reduced by half. Since the plants were not exposed to natural light but to continuous artificial light in an indoor environment without the natural means of fertilization (wind and/or insects), the experiment was discontinued after three months. At that time, the Test plant but not the Control plant had blossomed.

B. Superoxygenated water in field culture.

A pilot study was designed to ascertain that plants outside the hydroponic culture facility would benefit from the application of oxygen. It was decided to use water treated with the emitter of Example 1 as the oxygen carrier. Since water so treated is supersaturated, it is an excellent carrier of oxygen.

Tomato seeds (Burpee "Big Boy") were planted in one-inch diameter peat and dirt plugs encased in cheese cloth and placed in a tray in a southwest window. Controls were watered once a day with tap water ("Control") or oxygenated water ("Test"). Both Controls and Test sprouted at one week. After five weeks, the Test plants were an average of 11 inches tall while the Controls were an average of nine inches tall. At this time, May 10, when the threat of frost in Minnesota was minimal, the plants were transplanted to 13 inch diameter pots with drainage holes. Four inches of top soil was added to each pot, topped off with four inches of Scott's Potting Soil. The pots were placed outside in a sunny area with at least eight hours a day of full sun. The plants were watered as needed with either plain tap water (Control) or oxygenated water (Test). The oxygenated water was produced by use of the emitter of Example 1 run for one-half hour in a five-gallon container of water. Previous experiments showed that water thus treated had an oxygen content from 160% to 260% saturation. The Test plants flowered on June 4, while the Controls did not flower until June 18. For both groups, every plant in the group first had flowers on the same day. All plants were fertilized on July 2 and a soaker hose provided because the plants were now so big that watering by hand was difficult. The soaker hose was run for one half to one hour each morning, depending on the weather, to a point at which the soil was saturated with water. One half hour after the soaker hose was turned off, about 750 ml of superoxygenated water was applied to each of the Test plants.

The Test plants were bushier than the Controls although the heights were similar. At this time, there were eight Control plants and seven Test plants because one of the Test plants broke in a storm. On July 2, the control plants averaged about 17 primary branches from the vine stem, while the control plants averaged about 13 primary branches from the vine stem. As the tomatoes matured, each was weighed on a kitchen scale at harvest. The yield history is shown in Table II.

TABLE II

Week of:	Control, grams tomatoes from eight plants/cumulative total		Test, grams tomatoes from seven plants/cumulative total	
July 27	240		400	
August 3	180	420	2910	3310
August 10	905	1325	1830	5140
August 17	410	1735	2590	7730
August 24	3300	5035	2470	10200
August 31	4150	9175	1580	11780
September 15	not weighed		3710	15490
Final Harvest September 24	6435	15620	8895	24385

The total yield for the eight Control plants was 15620 grams or 1952 grams of tomatoes per plant. The total yield for the seven Test plants was 24385 grams or 3484 grams of tomatoes per plant, an increase in yield of about 79% over the Control plants.

Figure 6 shows the cumulative total as plotted against time. Not only did the Test plants blossom and bear fruit earlier, but that the Control plants never caught up to the test plants in the short Minnesota growing season. It should be noted that the experiment was terminated because of predicted frost. All fruits, both green and red, were harvested and weighed at that point.

Example 6. Flow-through emitter for agricultural use.

In order to apply the findings of example 5 to agricultural uses, an emitter than can oxygenate running water efficiently was developed. In Figure 7 (A), the oxygenation chamber is comprised of three anodes 1 and cathodes 2, of appropriate size to fit inside a tube or hose and separated by the critical distance are placed within a tube or hose 3 at 120° angles to each other. The anodes and cathodes are positioned with stabilizing hardware 4. The stabilizing hardware, which can be any configuration such as a screw, rod or washer, is preferably formed from stainless steel. Figure 7 (B) shows a plan view of the oxygenation chamber with stabilizing

hardware 4 serving as a connector to the power source and stabilizing hardware 5 serving as a connector to the power source. The active area is shown at 6.

This invention is not limited to the design selected for this embodiment. Those skilled in the art can readily fabricate any of the emitters shown in Figures 4 or 5, or can design other embodiments that will oxygenate flowing water. One useful embodiment is the "T" model, wherein the emitter unit is set in a side arm. The emitted bubbles are swept into the water flow. The unit is detachable for easy servicing. Table III shows several models of flow through emitters. The voltage and flowrates were held constant and the current varied. The Dissolved oxygen (DO) from the source was 7.1 mg/liter. The starting temperature was 12.2° C but the flowing water cooled slightly to 11 or 11.5° C. Without undue experimentation, anyone may easily select the embodiment that best suits desired characteristics from Table III or designed with the teachings of Table III.

TABLE III

MODEL	ACTIVE ELECTRODE AREA, SQ.IN.	VOLTAGE	CURRENT, AMPS	FLOW RATE GAL/MINUTE	DO OF* SAMPLE AT ONE MINUTE
2-inch "T"	2	28.3	0.7	12	N/A
3-inch "T"	3	28.3	1.75	12	N/A
2-plate Tube	20	28.3	9.1	12	8.4
3-Plate tube	30	28.3	12.8	12	9.6

*As the apparatus runs longer, the flowing water becomes milky, indicating supersaturation. The one-minute time point shows the rapid increase in oxygenation.

The following plants will be tested for response to superoxygenated water: grape vines, lettuce, and radishes in three different climate zones. The operators for these facilities will be supplied with units for drip irrigation. Drip irrigation is a technique wherein water is pumped through a pipe or hose with perforations at the site of each plant to be irrigated. The conduit may be underground or above ground. Since the water is applied directly to the plant rather than wetting

the entire field, this technique is especially useful in arid climates or for plants requiring high fertilizer applications.

The superoxygenated water will be applied by drip irrigation per the usual protocol for the respective plants. Growth and yield will be compared to the same plants given only the usual irrigation water. Pest control and fertilization will be the same between test and control plants, except that the operators of the experiments will be cautioned to be aware of the possibility of fertilizer burn in the test plants and to adjust their protocols accordingly.

It is expected that the superoxygenated plants with drip irrigation will show more improved performance with more continuous application of oxygen than did the tomato plants of Example 5, which were given superoxygenated water only once a day.

Example 7. Treatment of waste water.

Waste water, with a high organic content, has a high BOD, due to the bacterial flora. It is desirable to raise the oxygen content of the waste water in order to cause the flora to flocculate. However, it is very difficult to effectively oxygenate such water. Using a 4 inch OEM (see Table I) with a 12 volt battery, four liters of waste water in a five gallon pail were oxygenated. As shown in Figure 8, the dissolved oxygen went from 0.5 mg/l to 10.8 mg/l in nine minutes.

****

Those skilled in the art will readily comprehend that variations, modifications and additions may in the embodiments described herein may be made. Therefore, such variations, modifications and additions are within the scope of the appended claims.

I claim:

Claim 1. A flow-through oxygenator comprising an emitter for electrolytic generation of microbubbles of oxygen comprising an anode separated at a critical distance from a cathode and a power source all in electrical communication with each other, wherein the emitter is placed within or adjacent to a conduit for flowing water.

Claim 2. The emitter of claim 1 wherein the anode is a metal or a metallic oxide or a combination of a metal and a metallic oxide and the anode is platinum and iridium oxide on a support and the cathode is a metal or metallic oxide or a combination of a metal and a metallic oxide.

Claim 3. The critical distance of claim 1 which is 0.005 to 0.140 inches.

Claim 4. The critical distance of claim 1 which is 0.045 to 0.060 inches.

Claim 5. The product of claim 1 wherein the water is supersaturated with oxygen and of an approximately neutral pH.

Claim 6. A method for enhancing growth and yield of plants comprising the administration of supersaturated water on said plants.

Claim 7. The method of claim 6 wherein the supersaturated water is delivered to the plants in hydroponic culture or through drip irrigation.

Claim 8. A method for treating waste water comprising passing the waste water through a conduit comprising the emitter of claim 1.

ABSTRACT

An oxygen emitter which is an electrolytic cell is disclosed. When the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated. The very small oxygen bubbles remain in suspension, forming a solution supersaturated in oxygen. A flow-through model for oxygenating flowing water is disclosed. The use of supersaturated water for enhancing the growth of plants is disclosed. Methods for applying supersaturated water to plants manually, by drip irrigation or in hydroponic culture are described. The treatment of waste water by raising the dissolved oxygen with the use of an oxygen emitter is disclosed.

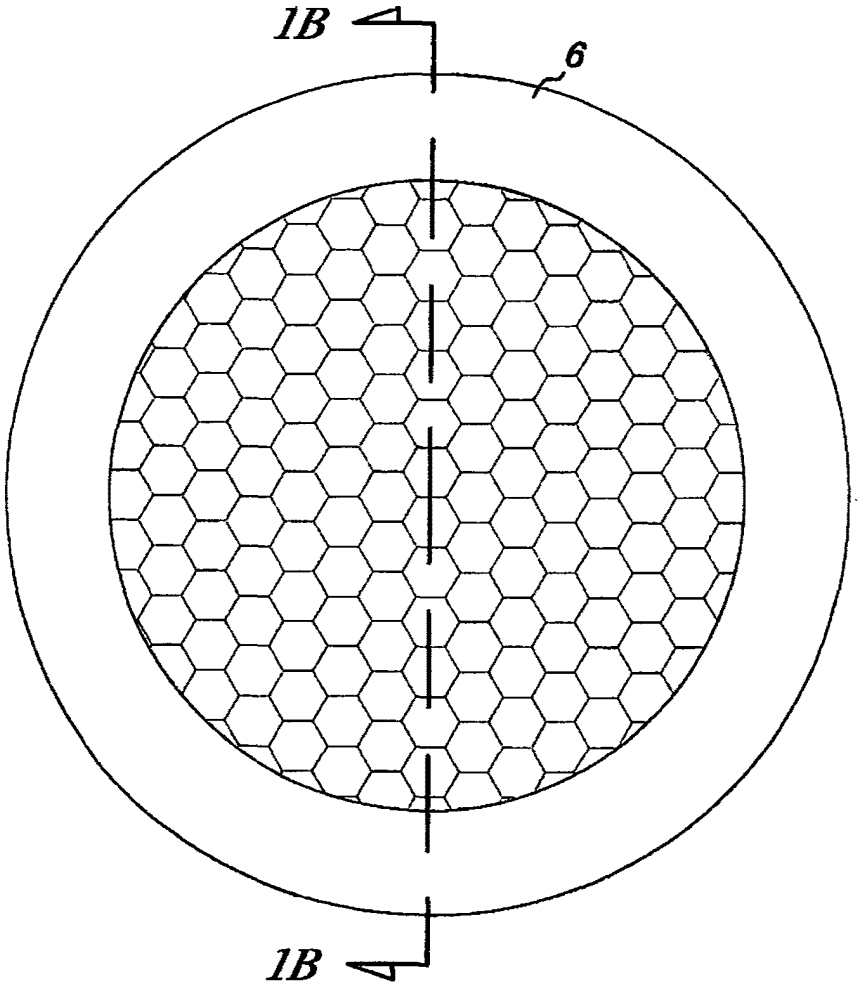


Fig. 1A

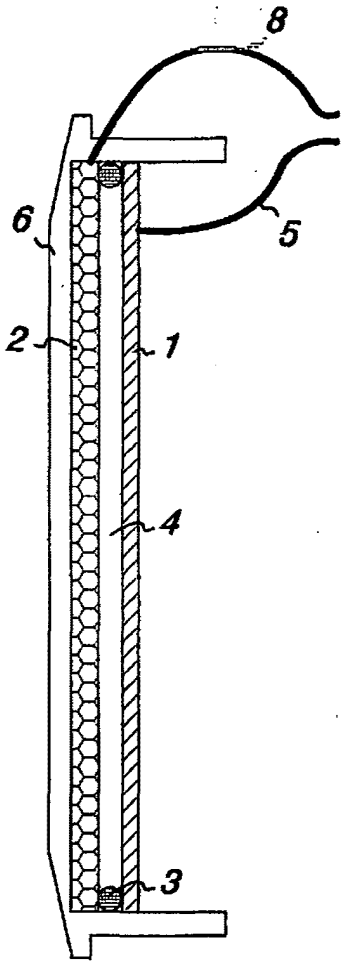


Fig. 1B

Fig. 2B

Fig. 2A

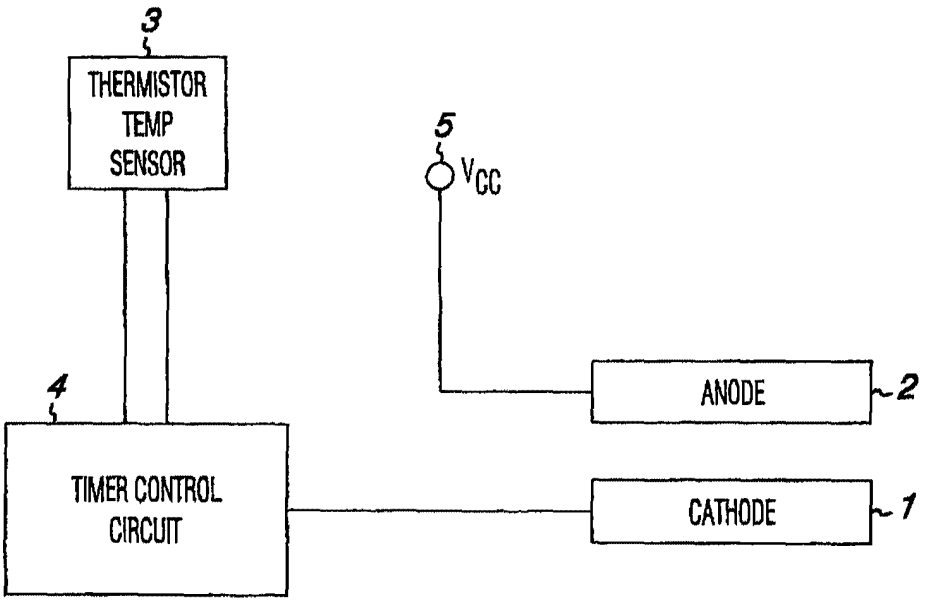

3
THERMISTOR
TEMP
SENSOR
5
V_{CC}
4
TIMER CONTROL
CIRCUIT
ANODE
2
CATHODE
1

Fig. 3

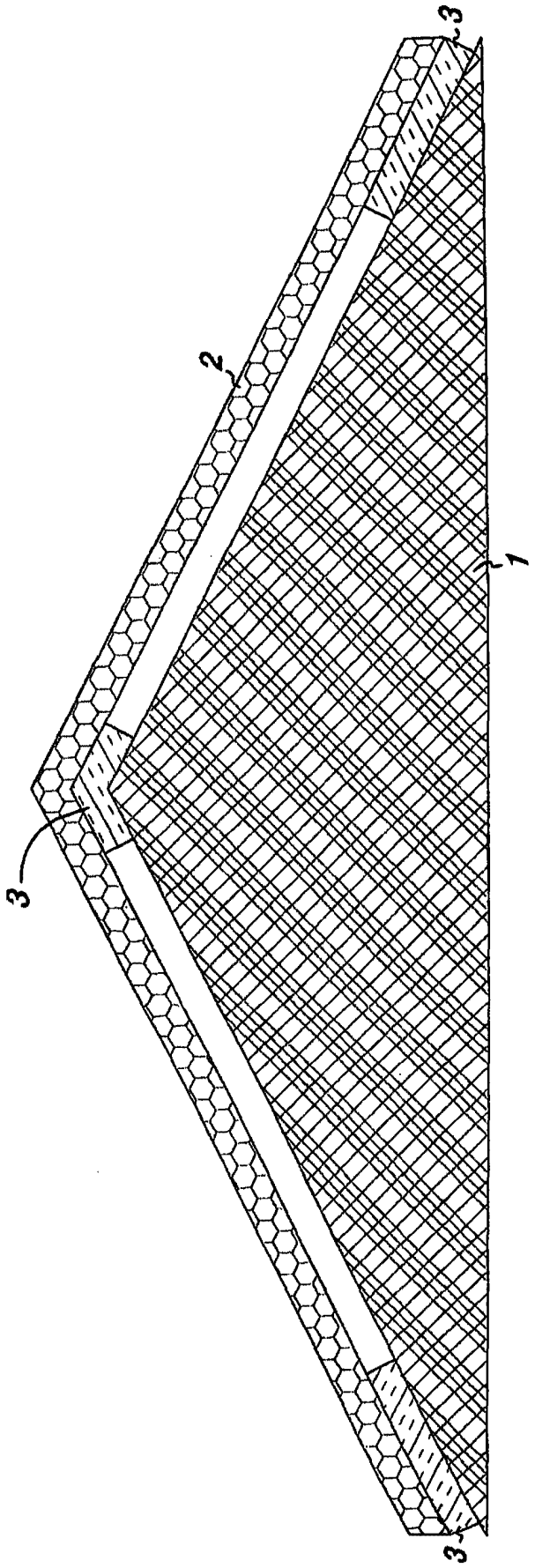


Fig. 4

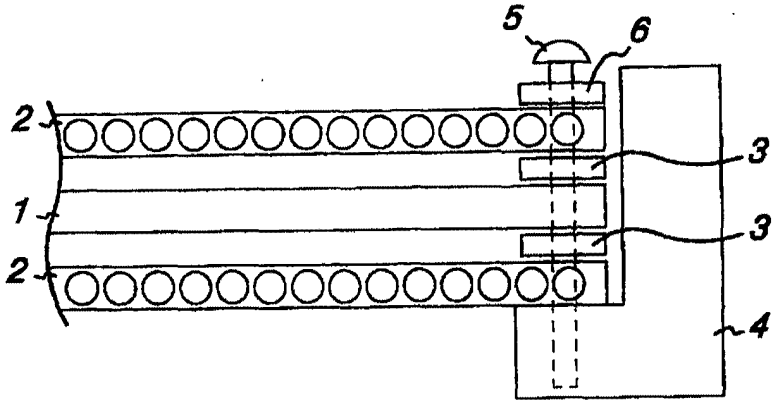


Fig. 5A

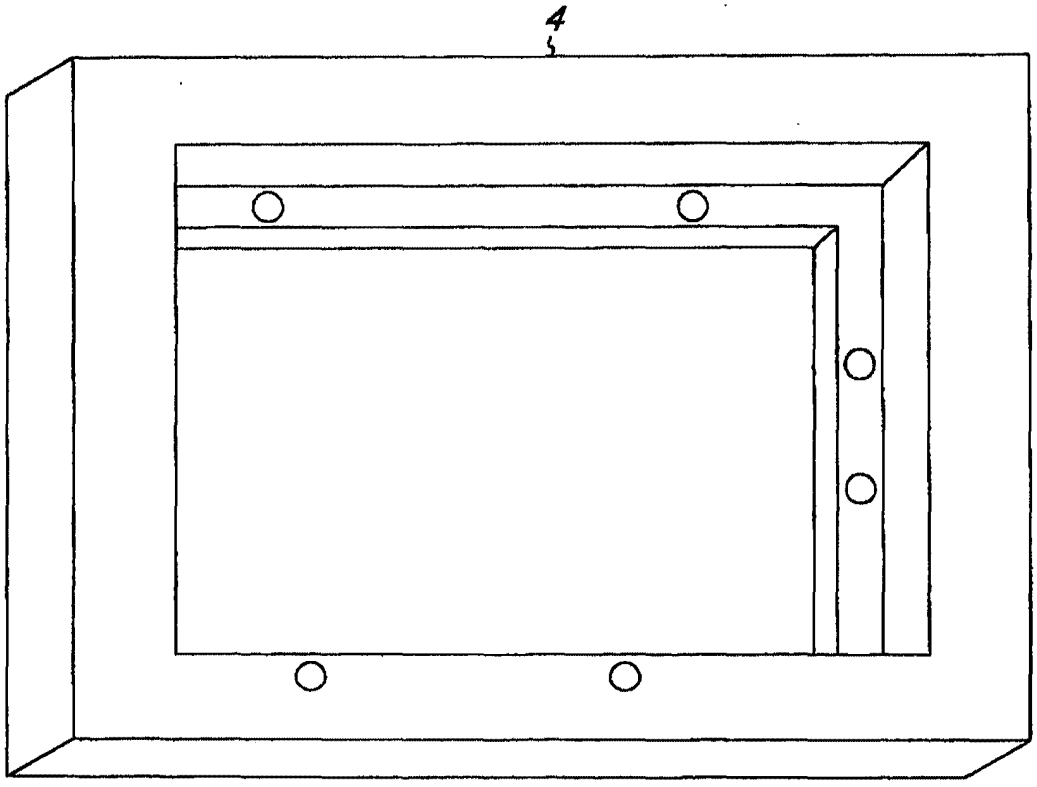


Fig. 5B

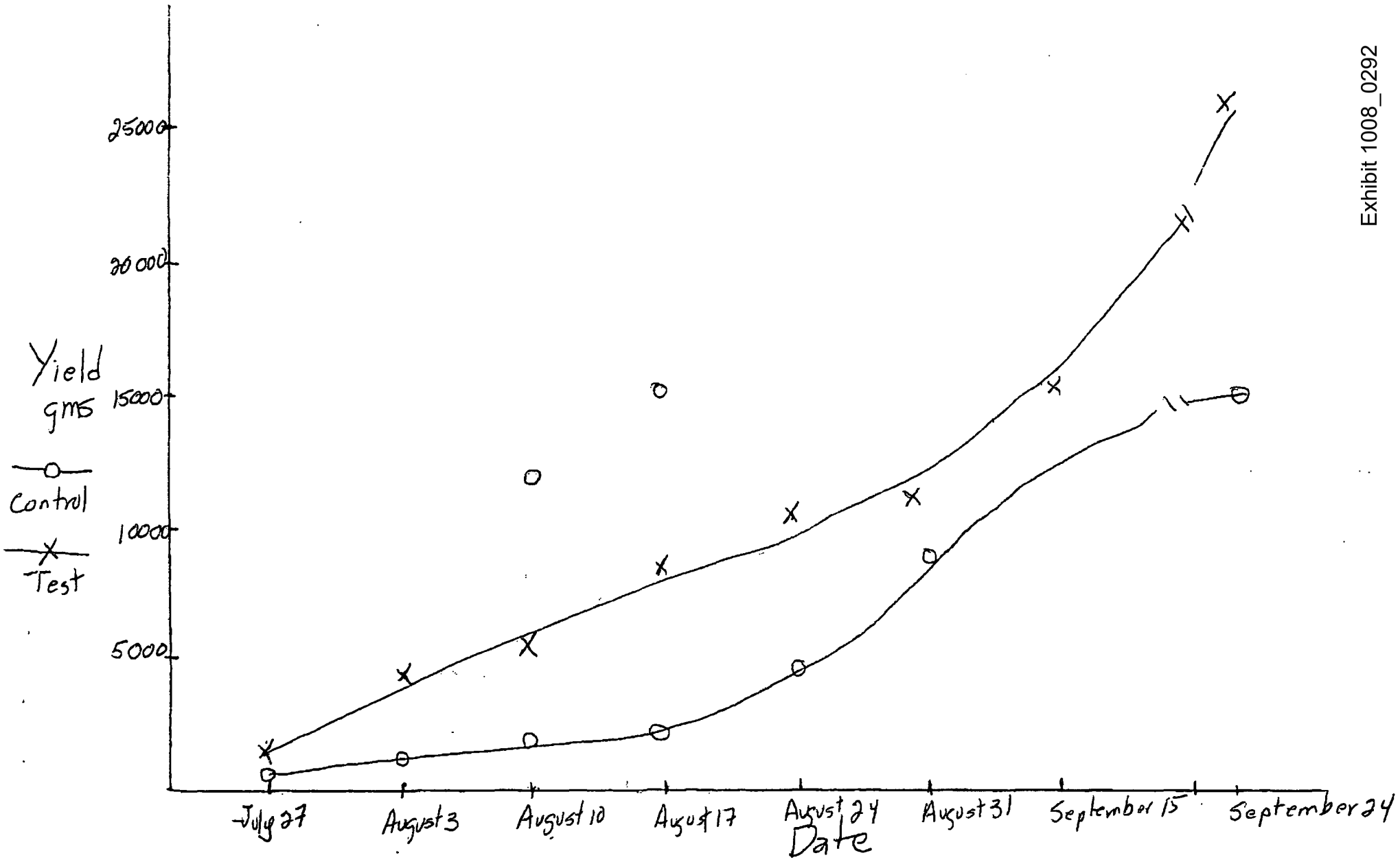
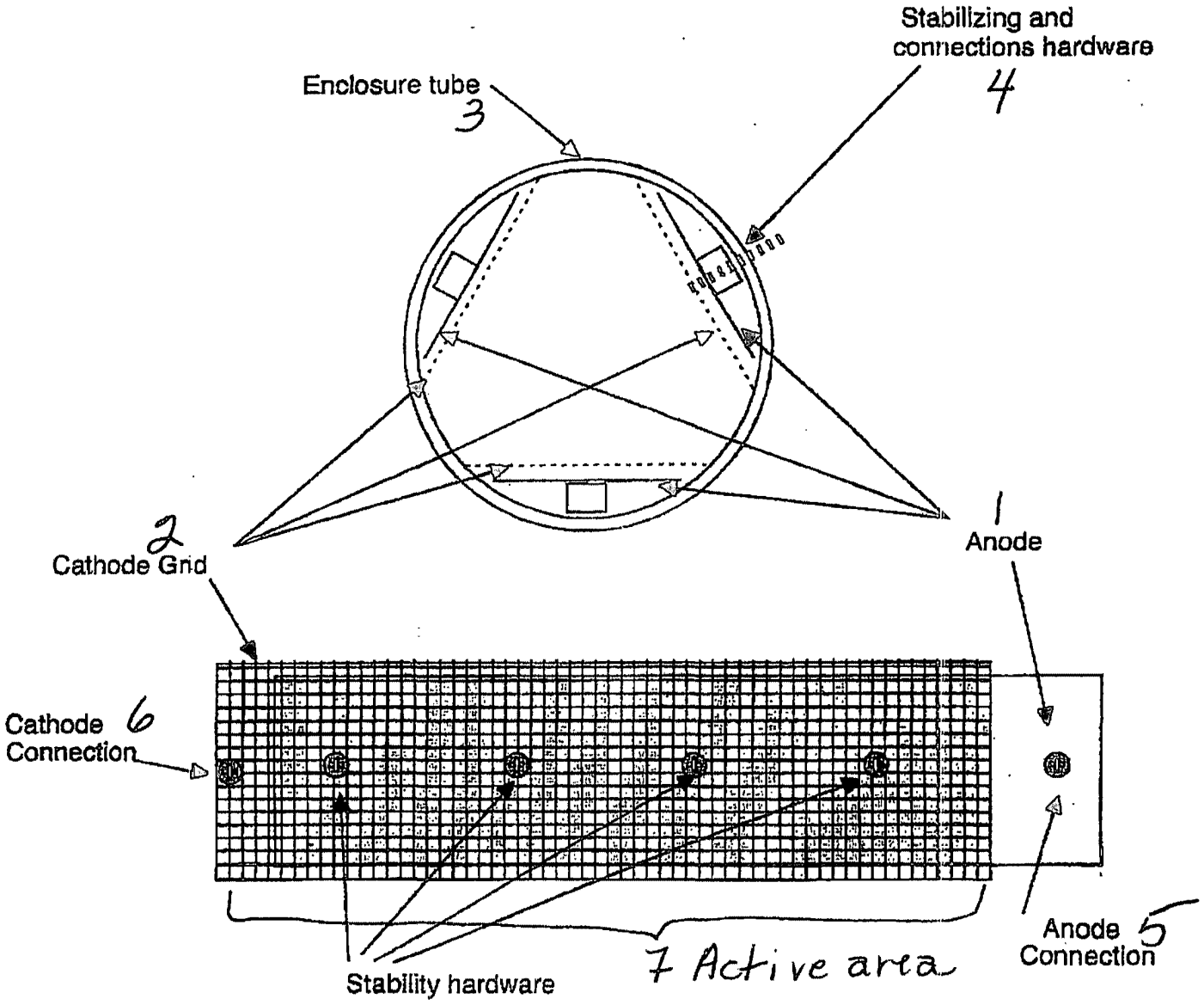


Figure 4

3 Element Flow Through Oxygenation Chamber



Depending on requirements tube can contain 1 2 3 4 or more elements.

Figure 7

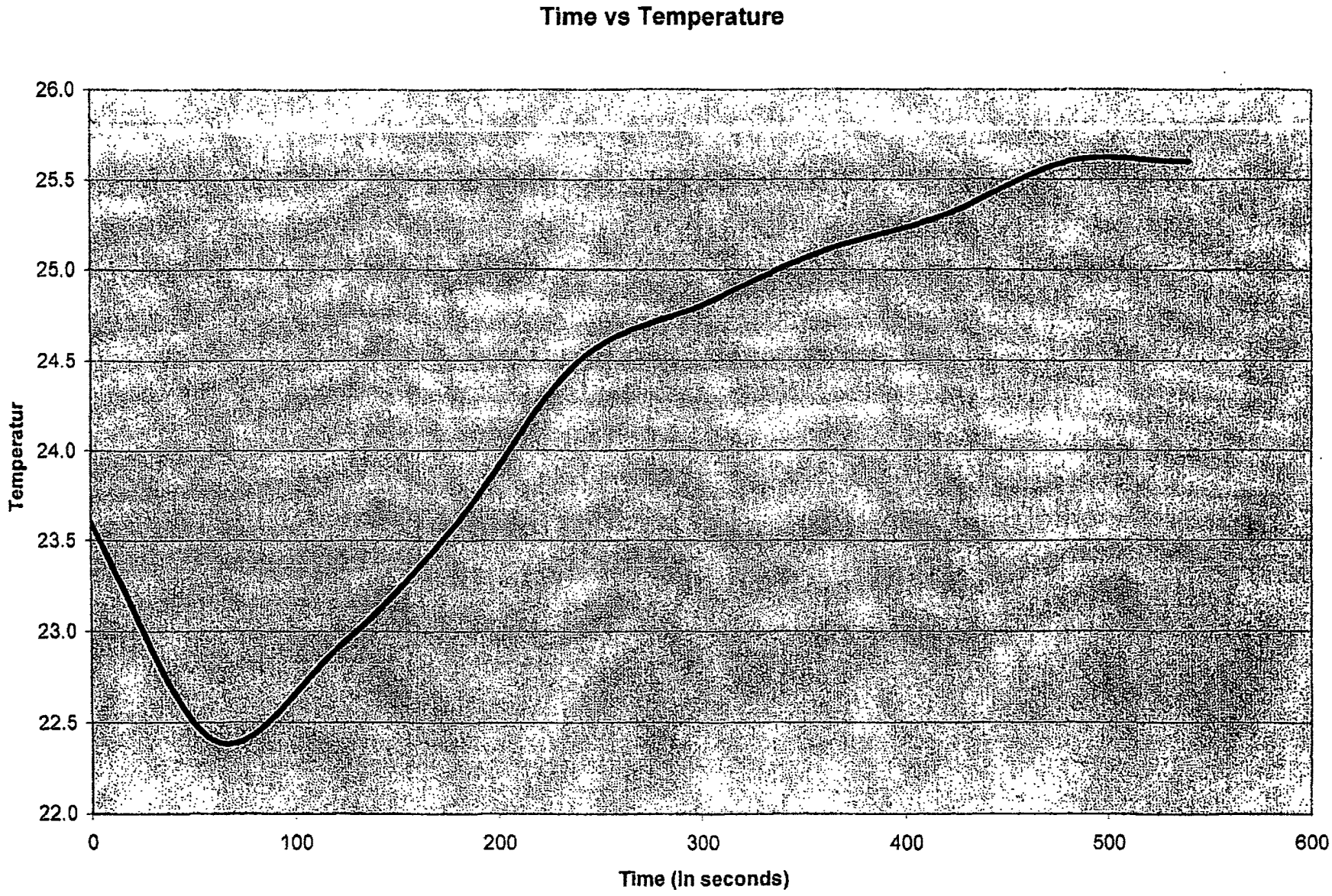


Figure 8

UNITED STATES PATENT APPLICATION

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name:

I verily believe that I am the original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled: **FLOW-THROUGH OXYGENATOR** the specification for which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 C.F.R § 1.56. I also acknowledge my duty to disclose all information known to be material to patentability which became available between a filing date of a prior application and the national or PCT filing date in the event this is a Continuation-in-Part application in accordance with 37 C.F.R. § 1.63(e).

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

Application Number	**Filing Date**
60/431,577	02/22/2002

I hereby claim the benefit under 37 C. F.R. § 1.63(E) of any United States provisional application(s) listed below:

Application Number	**Filing Date**
10/372,017	02/21/2003

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

Terry, Kathleen R.	Reg.No. 31884
McTavish, Hugh	Reg. No. 48341

Please direct all correspondence in this case to:

Kathleen R. Terry
2417 Como Avenue
St. Paul, MN 55108-1459
651-659-9819
Krterry@visi.com
FAX 651 603 1809

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application issued thereon.

Full name of sole inventor number:

Citizenship: United States of America

Residence Address: James Andrew Senkiw
4750 Aldrich Avenue North
Minneapolis, MN 55430-3529

Signature: _____ Date: 12/5/03

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number
10732326

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	8	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	8 minus 20=	*
INDEPENDENT CLAIMS	2 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL	385	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

1 6

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

12/12/2003 SZEWDIE1 00000033 10732326
01 FC:2001 385.00 OP

PTO-1556
(5/87)

Exhibit 1008_0298

*U.S. Government Printing Office: 2002 — 489-267/69033