

(12) **United States Patent**
Senkiw

(10) **Patent No.:** **US 6,689,262 B2**
(45) **Date of Patent:** **Feb. 10, 2004**

- (54) **MICROBUBBLES OF OXYGEN**
- (75) **Inventor:** **James Andrew Senkiw**, Minneapolis, MN (US)
- (73) **Assignee:** **Aqua Innovation, Inc.**, Bloomington, MN (US)
- (*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

4,908,109 A *	3/1990	Wright	210/703
5,049,252 A *	9/1991	Murrell	204/268
5,182,014 A *	1/1993	Goodman	209/164
5,534,143 A *	7/1996	Portier et al.	210/151
6,315,886 B1 *	11/2001	Zappi et al.	205/701
6,394,429 B2 *	5/2002	Ganan-Calvo	261/77
6,471,873 B1 *	10/2002	Greenberg et al.	210/748

FOREIGN PATENT DOCUMENTS

US WO 95/21795 * 8/1995

* cited by examiner

Primary Examiner—Bruce F. Bell
(74) *Attorney, Agent, or Firm*—Kathleen R. Terry

- (21) **Appl. No.:** **10/372,017**
- (22) **Filed:** **Feb. 21, 2003**
- (65) **Prior Publication Data**
US 2003/0164306 A1 Sep. 4, 2003

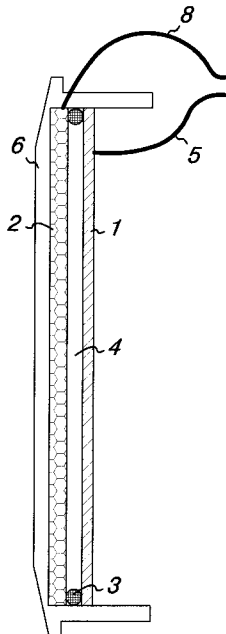
(57) **ABSTRACT**

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 hydrogen forms bubbles at the cathode, which bubbles rise to the surface. The very small oxygen bubbles remain in suspension, forming a solution supersaturated in 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. Models suitable for different uses are disclosed.

- Related U.S. Application Data**
- (60) Provisional application No. 60/358,534, filed on Feb. 22, 2002.
- (51) **Int. Cl.⁷** **C25B 9/00**
- (52) **U.S. Cl.** **204/278.5**; 204/272; 204/275.1; 205/755; 205/756; 205/757; 205/758; 205/626; 205/628; 205/633; 205/701
- (58) **Field of Search** 205/755, 756, 205/757, 758, 626, 628, 633, 701; 204/255, 256, 263, 266, 270, 272, 275.1, 278.5

- (56) **References Cited**
U.S. PATENT DOCUMENTS
- 3,975,269 A * 8/1976 Ramirez 210/707
- 4,012,319 A * 3/1977 Ramirez 210/707
- 4,732,661 A * 3/1988 Wright 204/278.5

14 Claims, 5 Drawing Sheets



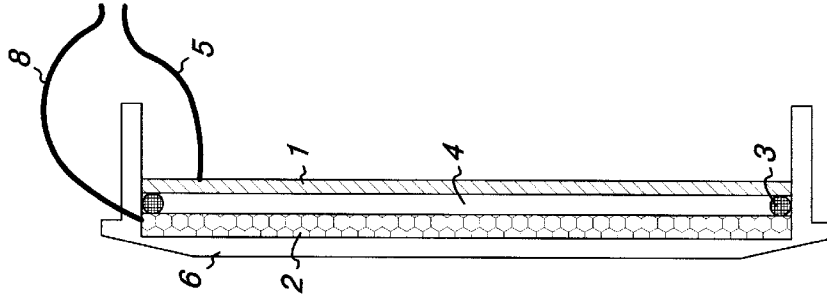


Fig. 1B

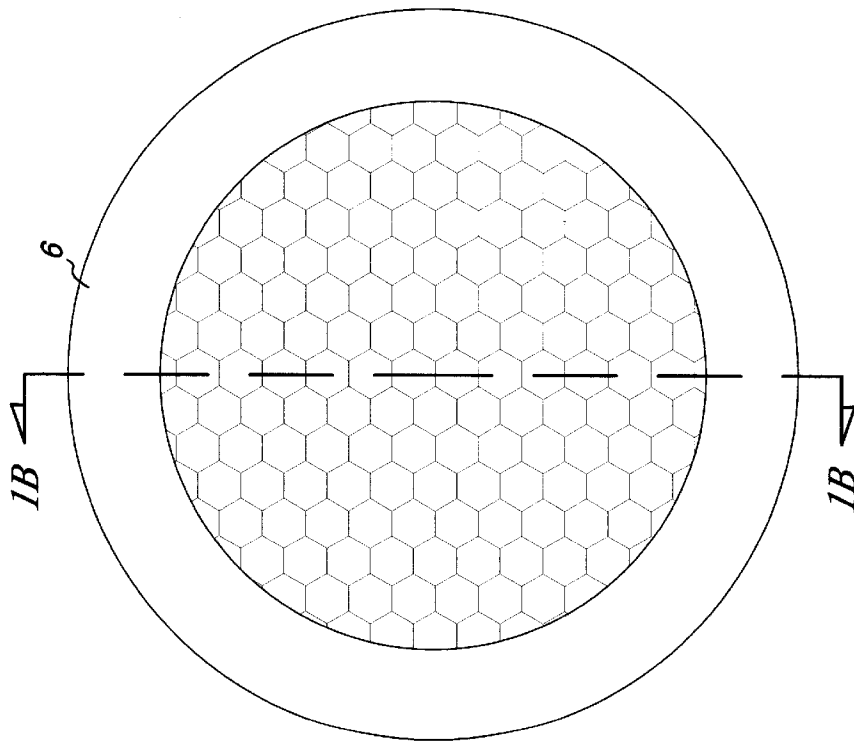


Fig. 1A

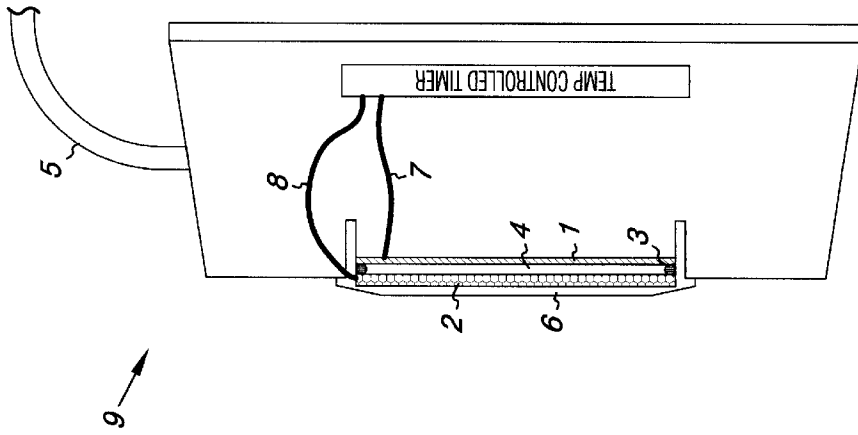


Fig. 2B

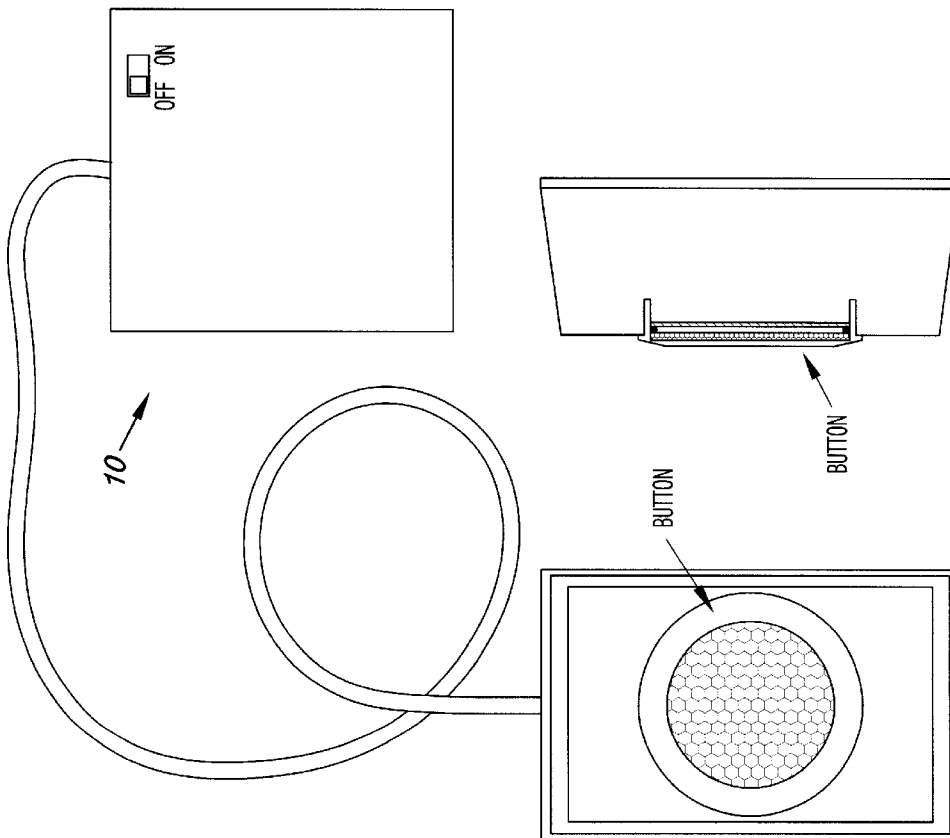


Fig. 2A

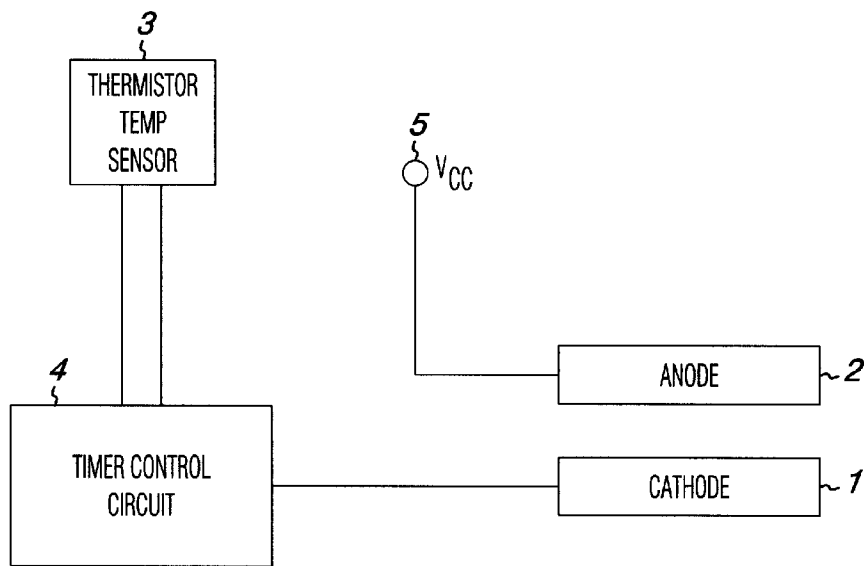


Fig. 3

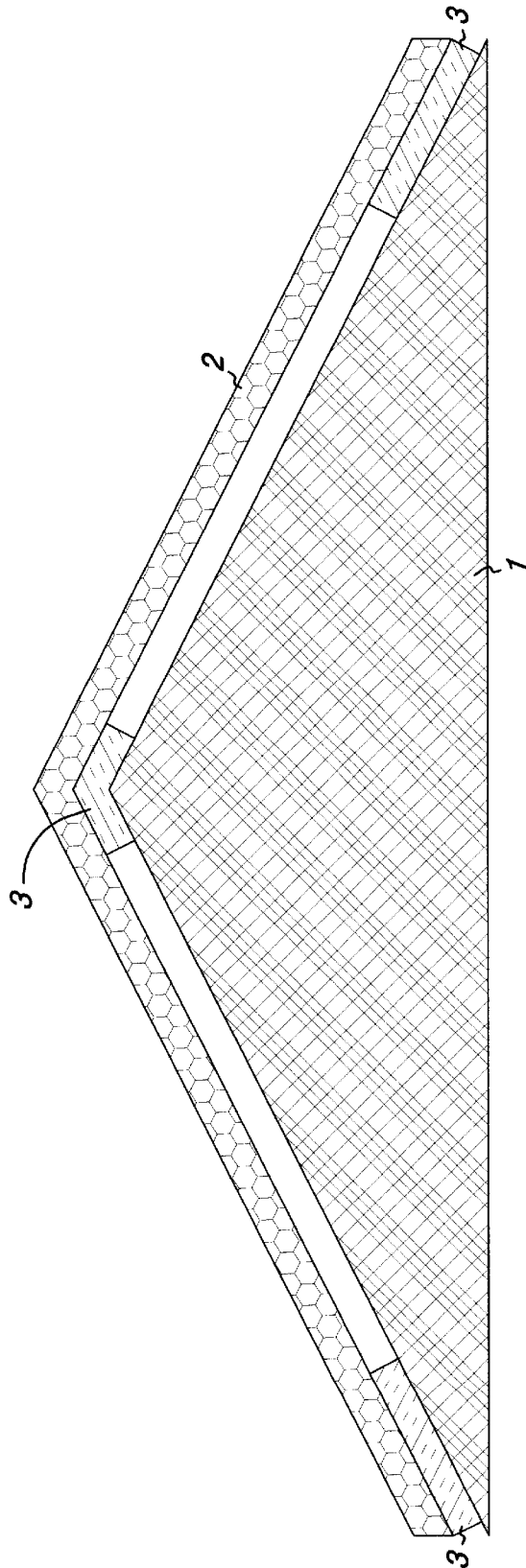


Fig. 4

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.