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(54) **REDUCTION DEVICE FOR NITRATE DETERMINATION**

6,030,520 A * 2/2000 Dziewinski et al. 205/771

OTHER PUBLICATIONS

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Gordon et al, A Suggested Protocol for Continuous Flow Automated Analysis of Seawater Nutrients in the WOCE Hydrographic Program and the Joint Global Ocen Fluxes Study, Nov. 4 1993, OSU Coll. of Oc. Descriptive Chem. Oc. Grp. Tech, p. 32-37.*

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M. P. Stainton, Simple Efficient Reduction Column for Use in the Automated Determination of Nitrate in Water, Sep. 1974, Analytical Chemistry, vol. 48 No. 11, 1515.*

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 667 days.

Raymond B. Willis and Claude E. Gentry, Automated Method for Determining Nitrate and Nitrite in Water and Soil Extracts, 1987, Commun. in soil sci. plant anal., 18(6), 625-636.*

(21) Appl. No.: **10/251,696**

Raymond B. Willis, Reduction Column for Automated Determination of Nitrate and Nitrite in Water, 1980, Analytical Chemistry, 52, 1377-1379.*

(22) Filed: **Sep. 18, 2002**

Article "Simple, Efficient Reduction Column for Use in the Automated Determination of Nitrate in Water", by M.P. Stainton, Analytical Chemistry, vol. 46, No. 11, Sep. 1974, p. 1618.

(51) **Int. Cl.**
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B01D 47/16 (2006.01)
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Article "Reduction Column for Automated Determination of Nitrate and Nitrite in Water", by Raymond B. Willis, Anal. Chem. 1988, 52, 1976, pp. 1376-1377.

(52) **U.S. Cl.** **422/139**; 261/94; 261/100; 261/103; 261/123; 422/68.1; 422/202

Article "Automated Method for determining Nitrate and Nitrite in Water and soil Extracts", by Raymond B. Willis and Claude E. Gentry, Commun in Soil Sci Plant Anal, 18(6), 625-636 (1987).

(58) **Field of Classification Search** 436/110, 436/169; 422/68.1, 202; 261/94, 100, 103, 261/123; 502/527.19

* cited by examiner

See application file for complete search history.

(56) **References Cited**

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U.S. PATENT DOCUMENTS

4,192,714 A * 3/1980 Vachon 376/220
5,300,441 A * 4/1994 Fujinari et al. 436/110
5,858,792 A * 1/1999 Fanning et al. 436/52

(57) **ABSTRACT**

A nitrate reduction device has a cadmium structure forming a plurality of longitudinal channels within a flow chamber, which may be formed by a plurality of wires. The device is used to reduce nitrate to a final nitrite product for analysis.

17 Claims, 7 Drawing Sheets

