



US006164127A

United States Patent [19]

[11] **Patent Number:** **6,164,127**

Izbicki et al.

[45] **Date of Patent:** **Dec. 26, 2000**

- [54] **WELL FLOWMETER AND DOWN-HOLE SAMPLER** 5,228,345 7/1993 Vales 73/152.23
 5,297,425 3/1994 Hamby et al. .
 5,337,838 8/1994 Sorensen .
 5,347,844 9/1994 Grob et al. 73/23.41
 [75] Inventors: **John Izbicki**, San Clemente; **Allen H. Christensen**, La Mesa; **Steven M. Crawford**, San Diego; **Randall T. Hanson**, San Diego; **Peter Martin**, San Diego; **Gregory Smith**, San Diego, all of Calif. 5,388,455 2/1995 Hamby et al. .
 5,520,046 5/1996 Somein et al. .
 5,901,788 5/1999 Brown et al. 73/152.23

[73] Assignee: **The United States of America as represented by the Secretary of the Interior**, Washington, D.C.

Primary Examiner—Hezron Williams
Assistant Examiner—Jay L. Politzer
Attorney, Agent, or Firm—E. Philip Koltos

[21] Appl. No.: **09/362,213**
 [22] Filed: **Jul. 28, 1999**

Related U.S. Application Data

- [62] Division of application No. 09/019,364, Feb. 5, 1998.
 [51] **Int. Cl.**⁷ **E21B 49/00; G01N 1/00**
 [52] **U.S. Cl.** **73/152.23; 73/864.31**
 [58] **Field of Search** **73/152.23, 864.61, 73/864.63, 864.31**

[56] **References Cited**

U.S. PATENT DOCUMENTS

- 2,453,456 11/1948 Piety .
 3,123,708 3/1964 Limanek .
 3,345,868 10/1967 Brink .
 3,824,850 7/1974 Nutter 73/152.23
 4,367,657 1/1983 Ward 73/152.23
 4,553,429 11/1985 Evans et al. .
 4,629,218 12/1986 Dubois .
 4,715,443 12/1987 Gidley .
 4,745,801 5/1988 Luzier .
 4,811,599 3/1989 Johnson et al. 73/152.23
 4,928,541 5/1990 Toon et al. 73/864.63

[57] **ABSTRACT**

An apparatus for and a process of evaluating well bore flow of water and for sampling of water within a well. A hose is inserted into the well to a known depth. To evaluate the water, a tracer fluid is introduced into the hose until the pressure within the hose exceeds the hydrostatic pressure at the known depth by a preset amount. The tracer fluid is then rapidly released into the well. The tracer fluid is detected in water pumped from the well, and the elapsed time between release of the tracer fluid into the well and detection of the tracer fluid in the water pumped from the well is determined. The process is repeated at a second known depth, and the tracer fluid travel time between the two depths is determined. From this and the cross-sectional area of the well, the incremental volumetric well bore inflow to the well between the two depths is calculated. The process can be repeated at several depths within the well to permit construction of a velocity profile of water movement within the well. To obtain a water sample from the well, the hose is inserted to the desired depth, and an inert gas is introduced into the hose. The gas is then vented from the hose, and water from the well enters the hose to replace the vented gas. The hose is then withdrawn from the well, and gas is again introduced into the hose, causing the water sample to be discharged. Appropriate valves are provided to control the apparatus.

18 Claims, 3 Drawing Sheets

