



United States Patent [19]

[11] **Patent Number:** **6,138,508**

Hannan et al.

[45] **Date of Patent:** ***Oct. 31, 2000**

[54] **DIGITAL LIQUID LEVEL SENSING APPARATUS**

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[73] Assignee: **KDI Precision Products, Inc.**, Cincinnati, Ohio

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[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

This patent is subject to a terminal disclaimer.

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[21] Appl. No.: **08/824,046**

[57] **ABSTRACT**

[22] Filed: **Mar. 21, 1997**

Related U.S. Application Data

A digital liquid level sensing apparatus for detecting variations in the dielectric of a substance being sensed. The apparatus includes a capacitive element array including a plurality of individual (i.e., segmented) input plates positioned along an axis of measurement of a fluid to be detected. The array also includes a common output plate having a length sufficient to span the entire accumulated length of the input plates. A controller sequentially applies DC excitation pulses to the input plates which cause a series of output currents to be coupled onto the output plate. The output currents are input to a current-to-voltage amplifier which generates a series of corresponding analog output voltages. The analog output voltages are then input to a peak voltage detector circuit to generate a series of peak voltage signals representative of the magnitudes of the analog output voltages. The controller converts each of the peak voltage signals into a corresponding digital value and stores each of the digital values in an on-board memory. The controller then sequentially compares each of the values against at least one predetermined reference value indicative of an output produced by an input plate disposed in air until a predetermined difference is detected between the reference value and any one of the stored digital values. This indicates a predetermined difference in the dielectric, thus indicating that a corresponding input plate is at least partially submerged in fluid.

[63] Continuation of application No. 08/328,679, Oct. 25, 1994, abandoned, which is a continuation-in-part of application No. 08/143,834, Oct. 27, 1993, Pat. No. 5,406,843.

[51] **Int. Cl.**⁷ **G01F 23/26**

[52] **U.S. Cl.** **73/304 C; 324/665**

[58] **Field of Search** 73/304 C; 364/509; 324/665, 658

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14 Claims, 5 Drawing Sheets

