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Patent

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The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

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Katherine Kelly Vidal

DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

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(12) **United States Patent**
Sengul et al.

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(54) **WELL PUMP DIAGNOSTICS USING MULTI-PHYSICS SENSOR DATA**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 114 days.

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CPC ***E21B 47/009*** (2020.05); ***E21B 47/007*** (2020.05); ***E21B 47/06*** (2013.01); ***E21B 47/18*** (2013.01)

(58) **Field of Classification Search**

CPC E21B 47/009; E21B 47/007; E21B 47/06; E21B 47/12; E21B 47/18

See application file for complete search history.

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(57) **ABSTRACT**

A method includes receiving acoustic signals from one or more acoustic sensors that are coupled to a beam pump unit. The method also includes identifying a frequency of the beam pump unit in the acoustic signals. The method also includes detecting an outlier in the acoustic signals based at least partially upon the identified frequency. The outlier represents an operational issue with the beam pump unit.

15 Claims, 14 Drawing Sheets