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**George**

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(54) **MULTIPOLE ACOUSTIC LOGGING WITH AZIMUTHAL SPATIAL TRANSFORM FILTERING**

GB 2130725 6/1984 ..... G01V/1/40  
GB 2132763 7/1984 ..... G01V/1/40

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(75) Inventor: **Wallace R. A. George**, Ridgefield, CT (US)

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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 270 days.

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(21) Appl. No.: **09/656,143**

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(51) Int. Cl.<sup>7</sup> ..... **F21B 7/00**

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(57) **ABSTRACT**

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A method and apparatus are provided for detecting a received acoustic pulse of a selected azimuthal borehole mode in a liquid-containing borehole in a formation. The method uses a sonde having an axial array of acoustic receiver stations aligned with the borehole, each receiver station having an azimuthal array of at least four piezoelectric receiver elements, the receiver elements uniformly spaced apart around the azimuthal array. An acoustic pulse transmitted within the borehole produces an electrical signal at each receiver element. Azimuthal spatial transform filtering is applied to produce data representing a received acoustic pulse of the selected azimuthal borehole mode. In one embodiment, azimuthal spatial DFT filtering is applied to digital data produced by analog to digital conversion. In another embodiment, cosine transform filtering is applied by an apodized receiver element.

**12 Claims, 8 Drawing Sheets**

