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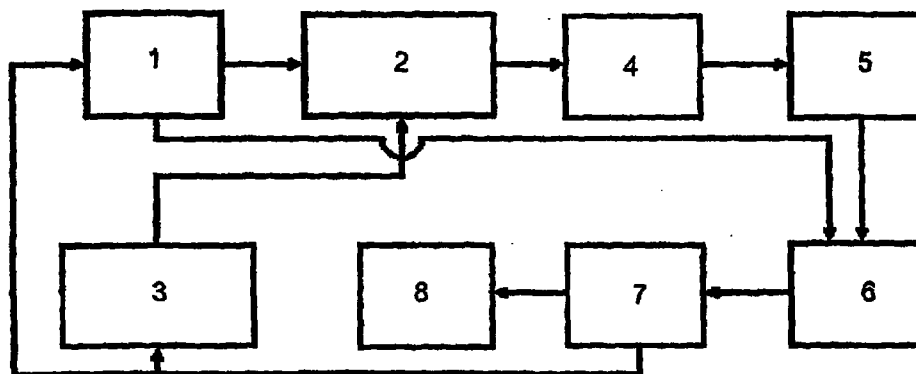
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(54) Title: A METHOD AND APPARATUS FOR DETECTING A SUBSTANCE USING NUCLEAR RESONANCE



(57) Abstract: A method and apparatus for detecting a prescribed substance in a specimen, using nuclear quadrupole resonance or nuclear magnetic resonance. The nuclei of the specimen are irradiated with a modified steady state free precession RF pulse sequence comprising a plurality of pulses. The pulse sequence includes pairs of pulses offset from each other by a prescribed phase shift to produce a plurality of nuclear resonance echo signals from the prescribed substance, if present. The pulse sequence is constructed with pairs of pulses where phases of adjacent pulse pairs are offset by 90° of the type: $[\tau/2 - (\theta - \Delta\tau - \theta)_{90} - \tau - (\theta - \Delta\tau - \theta)_{90} - \tau/2]_n$, and where the transmit frequency has an offset relative to the resonant frequency of an irradiated nuclei of the prescribed substance. The echo signals are analysed using Fourier transform and filtering techniques to register only those echo signals that are near the resonance frequencies of irradiated nuclei of the prescribed substance being detected. The registered echo signals are then compared with set reference values corresponding to the prescribed substance to determine whether the prescribed substance is present or not in the specimen. This type of detection method is not affected by temperature variations or other factors that create intensity anomalies. The pulse sequence creates additional echo signals, which increases the intensity of the observed signal and thus the signal to noise ratio. It also attenuates the effect of magneto-acoustic ringing.



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