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# United States Patent [19]

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**Baumuel**

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[54] **INSERTION ULTRASONIC TRANSDUCER WITH MODE CONVERSION AND METHOD FOR REDUCING MULTIPLE SIGNAL RECEPTION**

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[57] **ABSTRACT**

An insertion type ultrasonic transducer assembly adapted to be mounted to a pipe for determining ultrasonic energy transit time through fluid in the pipe. The assembly includes an ultrasonic transducer and a coupling rod having the ultrasonic transducer mounted on a first end thereof and having a second end thereof adapted for disposition through an opening in a fluid containing pipe. The first end has a surface formed at a first angle which ensures that substantially all ultrasonic energy emitted by the transducer in a primary beam is converted at least once from a first mode to a second mode at a boundary surface of the coupling rod, thereby resulting in emission of a longitudinal mode wave at the second end of the coupling rod into the fluid in the pipe. The second end is formed at a second angle which ensures that the emitted longitudinal mode wave is emitted orthogonally with respect to the surface of the second end without refraction as the emitted wave enters the fluid in the pipe. The device allows for more accurate determination of ultrasonic energy transit time through the fluid in the pipe by eliminating or substantially reducing multiple receive signals.

[21] Appl. No.: **312,299**

[22] Filed: **Sep. 26, 1994**

[51] Int. Cl.<sup>6</sup> ..... **H04R 23/00; G01F 1/66**

[52] U.S. Cl. .... **367/140; 73/861.27; 73/861.28**

[58] Field of Search ..... **367/140; 73/861.26, 73/861.27, 861.28**

[56] **References Cited**

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**31 Claims, 3 Drawing Sheets**

