

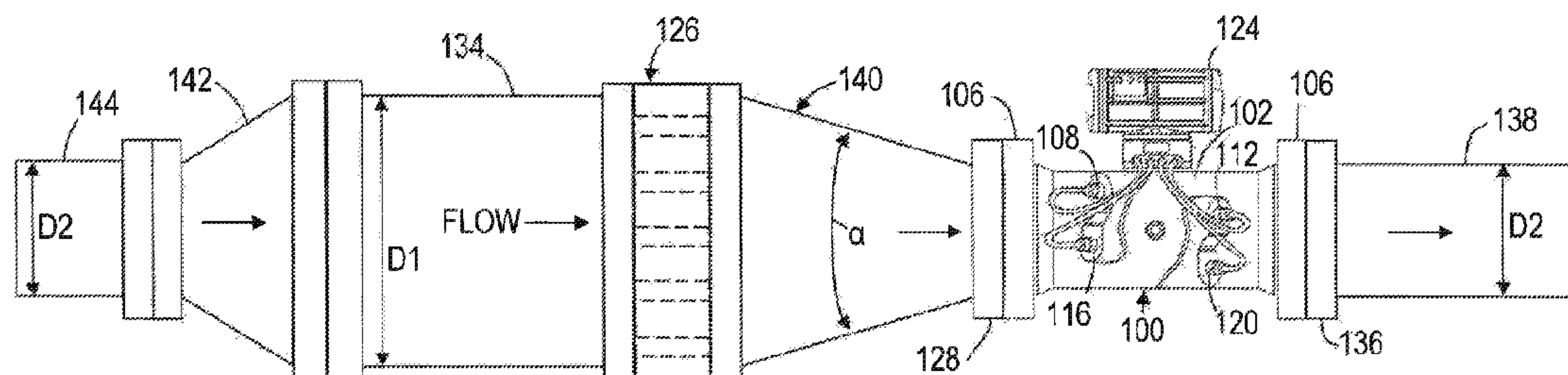


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A TURBULENT

(54) Title: ULTRASONIC FLOW METERING WITH LAMINAR TO TURBULENT TRANSITION FLOW CONTROL



(57) Abrégé/Abstract:

Apparatus and method for ultrasonic flow metering of viscous fluids. In one embodiment, an ultrasonic flow metering system includes an ultrasonic flow meter, a flow conditioner, and a reducer. The ultrasonic flow meter includes a pair of ultrasonic transducers arranged to exchange ultrasonic signals through a fluid stream flowing between the transducers. The flow conditioner is disposed upstream of the ultrasonic flow meter. The reducer is disposed between the flow conditioner and the ultrasonic flow meter to reduce the cross sectional area of the fluid stream flowing from the flow conditioner to the ultrasonic flow meter.

ULTRASONIC FLOW METERING WITH LAMINAR TO TURBULENT TRANSITION FLOW CONTROL

BACKGROUND

[0001] Hydrocarbon fluids are transported from place-to-place via pipelines. It is desirable to know with accuracy the amount of fluid flowing in the pipeline, and particular accuracy is demanded when the fluid is changing hands, or “custody transfer.” Even where custody transfer is not taking place, however, measurement accuracy is desirable, and in these situations, flow meters may be used.

[0002] Ultrasonic flow meters are one type of flow meter that may be used to measure the amount of fluid flowing in a pipeline. Ultrasonic flow meters have sufficient accuracy to be used in custody transfer. In an ultrasonic flow meter, acoustic signals are sent back and forth across the fluid stream to be measured. Based on parameters of received acoustic signals, the fluid flow velocity in the flow meter is computed. The volume of fluid flowing through the meter can be determined from computed flow velocities and the known cross-sectional area of the flow meter.

[0003] Accurate measurement of flow velocity at an ultrasonic flow meter requires a well developed flow profile. Conventional ultrasonic flow metering systems provide such a flow profile by positioning either a long stretch of straight pipe or a flow conditioning device upstream of the ultrasonic flow meter.

SUMMARY

[0004] Systems and methods for ultrasonic flow metering of viscous fluids are disclosed herein. In one embodiment, an ultrasonic flow metering system includes an ultrasonic flow meter, a flow conditioner, and a reducer. A pipe reducer is an apparatus that transitions a pipe from a larger bore diameter upstream to a smaller bore diameter downstream. The ultrasonic flow meter includes a pair of ultrasonic transducers arranged to exchange ultrasonic signals through a fluid stream flowing between the transducers. The flow conditioner is disposed upstream of the ultrasonic flow meter. The reducer is disposed

