DETECTION SYSTEM FOR FLOW CONTROL APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 63/028,951 filed on May 22, 2020, the contents of which are incorporated by reference herein in their entirety.

TECHNICAL FIELD

[0002] The present disclosure generally relates to a flow control apparatus capable of detecting a condition of a pump set mounted on the apparatus.

BACKGROUND

[0003] Administering fluids containing medicine or nutrition to a patient is generally well known in the art. Typically, fluid is delivered to the patient by a pump set received by a flow control apparatus, such as a pump, connected to a source of fluid which delivers fluid to a patient. A flow control apparatus of the prior art may also be capable of monitoring and detecting fluid flow conditions that can occur within the loaded administration feeding set during operation of the flow control apparatus. Generally, prior art flow monitoring systems that are capable of monitoring and detecting flow conditions may rely on sensors arranged relative to the administration feeding set.

SUMMARY

[0004] The following presents a simplified summary of one or more implementations of the present disclosure in order to provide a basic understanding of such implementations. This summary is not an extensive overview of all contemplated implementations, and is intended to neither identify key or critical elements of all implementations nor delineate the scope .of any or all implementations. Its sole purpose is to present some concepts of one or more implementations of the present disclosure in a simplified form as a prelude to the more detailed description that is presented later.

[0004a] According to a first aspect of the present invention, there is provided a flow control apparatus comprising: a housing configured to receive a feeding set; a pumping device configured to produce a fluid flow in the feeding set; an ultrasonic sensor configured to produce a sensor signal indicative of a condition of the feeding set based on a first ultrasonic signal or a second ultrasonic signal, wherein the ultrasonic sensor

comprises a plurality of sensor components, the ultrasonic sensor being further configured to emit a first ultrasonic signal though a portion of the feeding set in a first direction from a first sensor component of the plurality of sensor components, and to emit a second ultrasonic signal through the portion of the feeding set in a second direction opposite the first direction from a second sensor component of the plurality of sensor components; and a control circuit in communication with the ultrasonic sensor configured to receive the sensor signal from the ultrasonic sensor indicative of the condition of the feeding set.

[0004b] According to a second aspect of the present invention, there is provided a method of operating a flow control apparatus, the method comprising: emitting via a first sensor component a first ultrasonic signal in a first direction though a portion of a pump set; emitting via a second sensor component a second ultrasonic signal in a second direction though the portion of a pump set, the second direction being opposite the first direction; detecting the first ultrasonic signal to determine a first sensor reading; detecting the second ultrasonic signal to determine a second sensor reading; comparing an amplitude of the first sensor reading to an amplitude of the second sensor reading; and detecting a condition of the pump set based on the comparing of the first sensor reading and the second sensor reading.

[0004c] According to a third aspect of the present invention, there is provided a flow control apparatus comprising: a memory; and at least one processor coupled with the memory and configured to: emit a first ultrasonic signal in a first direction though a portion of a pump set; emit a second ultrasonic signal in a second direction though the portion of a pump set, the second direction being opposite the first direction; detect the first ultrasonic signal to determine a first sensor reading; detect the second ultrasonic signal to determine a second sensor reading; compare an amplitude of the first sensor reading to an amplitude of the second sensor reading; and detect a condition of the pump set based on the comparing of the first sensor reading and the second sensor reading.

[0004d] According to a fourth aspect of the present invention, there is provided a flow control apparatus comprising: a housing configured to receive a feeding set; a pumping device configured to produce a fluid flow in the feeding set; an ultrasonic sensor including a first sensor component and a second sensor component, the first sensor component configured to emit a first ultrasonic signal though a portion of the feeding set in a first direction and the second sensor component configured to emit a second

ultrasonic signal though the portion of the feeding set in a second direction; and a control circuit configured to switch between a first configuration and a second configuration, whereby the first configuration includes the first sensor component emits the first ultrasonic signal directed to the second sensor component for detection by the second sensor component, and wherein the second configuration includes the second sensor component emits the second ultrasonic signal directed to the first sensor component for detection by the first sensor component.

[0005] In one aspect, the disclosure provides a system, method and non-transitory computer readable medium storing computer executable instructions that may be executed by a processor for detecting the flow of a fluid via a control apparatus. The system, method and non-transitory computer readable medium may include a housing capable of receiving a portion of the feeding set. The system, method and non-transitory