small, low cost device, secondary feedback systems would be prohibitively large and expensive. The present invention provides such feedback.

Embodiments of the present invention provide a system and method for providing a dry powder inhaler. Briefly described, in architecture, one embodiment of the system, among others, can be implemented as follows. The dry powder inhalersystem includes a vibrating mechanism. A container holds a supply of a dry powder is operatively coupled to the vibrating mechanism. A power source communicates with the vibrating mechanism. A sensor communicates with the vibrating mechanism and the sensor is positioned to measure a vibration of the vibrating mechanism. A feedback control communicates with the sensor and the power source. The feedback control controls power delivered to the vibrating mechanism relative to information provided by the sensor about the performance of the vibrating mechanism. A frequency sweep generator is connected between the power source and the vibrating mechanism and the frequency sweep generator is used for controlling a characteristic of power delivered to the vibrating mechanism. The vibrating mechanism comprises a piezoelectric transducer and the sensor detects voltage output from the piezoelectric transducer.

The present invention can also be viewed as providing methods for providing feedback control for a dry powder inhaler. In this regard, one embodiment of such a method, among others, can be broadly summarized by the following steps: driving a vibrating mechanism to an approximate steady state using a first power input; removing the first power input, wherein a vibration of at least a portion of the vibrating mechanism continues; sensing the vibration of the vibrating mechanism after the voltage input is removed; repeating the steps of driving, removing, and sensing with a plurality of different power inputs; determining which of the voltage inputs produced a largest sensed vibration; and positioning the vibrating mechanism to disaggregate the dry powder, wherein the step of sensing the vibration further comprises detecting an output voltage from the piezoelectric transducer.

Other systems, methods, features, and advantages of the present invention will be or become apparent to one with skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

Many aspects of the invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a cross-sectional side view of an inhaler, in accordance with a first exemplary embodiment of the present invention; and