

METHODS AND SYSTEMS OF SUPPLYING THERAPEUTIC GAS BASED ON INHALATION DURATION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 62/914,647 filed October 14, 2019 and titled “Methods and Systems of Supplying Therapeutic Oxygen,” and the provisional application is incorporated by reference herein as if reproduced in full below.

BACKGROUND

[0002] Patients with respiratory ailments may be required to breathe a therapeutic gas, such as oxygen. The therapeutic gas may be delivered to the patient from a therapeutic gas source by way of a nasal cannula. In some cases, therapeutic gas is delivered to a patient in continuously. That is, in continuous delivery the therapeutic gas is supplied at a constant flow rate throughout the patient's entire breathing cycle (i.e., both inhalation and exhalation).

SUMMARY

[0003] One ~~example embodiment~~aspect of the present disclosure refers to is a method of providing therapeutic, the method comprising: sensing a current inhalation; providing a flow of therapeutic gas based on the sensing; and ceasing the flow of therapeutic gas to the patient based on a value indicative of previous inhalation duration.

[0004] In ~~the an~~ example method, ceasing the flow of therapeutic gas may further comprise ceasing based on a predetermined percentage of the value indicative of previous inhalation duration. Ceasing flow may further comprise ceasing the flow after a flow duration being sixty percent of the value indicative of previous inhalation duration. The example method may further comprise assigning the value indicative of previous inhalation duration to be a duration of an immediately previous inhalation. The example method may further comprise assigning the value indicative of previous inhalation duration to be an average duration of a plurality of previous inhalations. The example method may further comprise assigning the value indicative of previous inhalation duration to be an average duration of three previous inhalations.

[0005] The example method may further comprise, after the ceasing, pre-charging a cannula with therapeutic gas prior to a subsequent inhalation of the patient. Pre-charging the cannula may further comprise providing a volume of therapeutic to the cannula that displaces only the gas in the cannula.

[0006] The example method may further comprise determining a most open airway, and wherein providing the flow of therapeutic gas further comprises providing the flow to the most open airway.

[0007] In the example method, providing the flow of therapeutic gas may further comprise providing from a source of therapeutic gas having a dead-head pressure of 8 psig or less.

[0008] Another ~~example embodiment~~aspect of the present disclosure refers to is a therapeutic gas delivery device comprising:

[0009] a controller; a first sensor electrically coupled to the controller and configured to fluidly couple to a first hose connection, the first sensor senses an attribute of airflow through the first hose connection; a first valve electrically coupled to the controller and configured to fluidly couple a source hose connection to the first hose connection; a second sensor electrically coupled to the controller and configured to fluidly couple to a second hose connection, the second sensor senses an attribute of airflow of the second hose connection; and a second valve electrically coupled to the controller and configured to fluidly couple the source hose connection to the second hose connection. The controller ~~may be~~is configured to: sense a current inhalation by way of the first sensor or the second sensor; provide, based on the sensing, a flow of therapeutic gas to the first hose connection by way of the first valve; and cease the flow of therapeutic gas to the first hose connection based on a value indicative of previous inhalation duration.

[0010] In ~~the an~~ example therapeutic gas delivery device, when the controller ceases the flow of therapeutic gas, the controller may be further configured to cease based on a predetermined percentage of the value indicative of previous inhalation duration. When the controller ceases the flow of therapeutic gas, the controller may be further configured to cease the flow after a flow duration being sixty percent of the value indicative of previous inhalation duration. The controller may be further configured to assign the value indicative of previous inhalation duration to be a duration of an immediately previous inhalation. The may be further configured to assign the value indicative of previous

inhalation duration to be an average duration of a plurality of previous inhalations. The controller may be further configured to assign the value indicative of previous inhalation duration to be an average duration of three previous inhalations.

[0011] In the example therapeutic gas delivery device, the controller may be further configured to, after the cessation, provide a pre-charge of therapeutic gas to both the first and second hose connections prior to a subsequent inhalation.

[0012] In the example therapeutic gas delivery device, the controller may be further configured to determine, based on the first and second sensors, that the first hose connection has a greater flow volume.

[0013] Another aspect of the present disclosure refers to an example system ~~comprises~~comprising: a source of therapeutic gas; a bifurcated nasal cannula; and a therapeutic gas delivery device coupled to the source of therapeutic gas, and coupled to the bifurcated nasal cannula. The therapeutic gas delivery device ~~may~~comprises: a controller; a first sensor electrically coupled to the controller and configured to fluidly couple to first lumen of the bifurcated nasal cannula, the first sensor senses an attribute of airflow through the first lumen; a first valve electrically coupled to the controller and configured to fluidly couple the source of therapeutic gas to the first lumen; a second sensor electrically coupled to the controller and configured to fluidly couple to a second lumen of the bifurcated nasal cannula, the second sensor senses an attribute of airflow of the second lumen; and a second valve electrically coupled to the controller and configured to fluidly couple the source of therapeutic gas to the second lumen. The controller ~~may be~~is configured to: sense a current inhalation by way of the first sensor or the second sensor; and provide a flow of therapeutic gas to the first lumen of the bifurcated nasal cannula for a time duration determined based on a value indicative of previous inhalation duration.

[0014] In ~~the an~~ example system, when the controller provides the flow of therapeutic gas, the controller may be further configured to provide the flow based on a predetermined percentage of the value indicative of previous inhalation duration. When the controller provides the flow of therapeutic gas, the controller may be further configured to provide the flow based for the time duration being sixty percent of the value indicative of previous inhalation duration.