Docket #: S20-166

EMERGENCY USE VENTILATOR

Researchers at Stanford have developed a low-cost and rapidly scalable emergency use ventilator for the COVID-19 crisis.

The high incidence of COVID-19-related respiratory failure has exposed critical shortages in the supply of mechanical ventilators. Mechanical ventilators, devices that facilitate both oxygenation and ventilation, must reliably deliver a specific volume of gas in a specific time interval. Mechanical ventilators traditionally rely on an internal compressor and mixer to moderate and control the positive-pressure gas mixture delivered to a patient. However, the current COVID-19 pandemic has spurred alternative designs of "emergency response" ventilators to help address the increased demand.

Stage of Research
The inventors have developed a ventilator, designed in accordance with the Emergency Use guidance provided by the US Food and Drug Administration (FDA), that can be used to support patients when the demand for ventilators exceeds hospital supplies. Their device is based on a continuous flow design, wherein an external premixed gas supply (oxygen/air) feeds into the ventilator and time-limited flow interruption guarantees tidal volume. The device is designed to control flow through valve timings, enabling both non-invasive care and invasive care (i.e., assisted and mandatory) modes of ventilation. For invasive ventilation modes, the ventilator relies on a pressure-limited-time-cycled breathing loop, and a tidal volume is set by allowing a known flowrate of gas to flow for a specified time. The inventors demonstrate the effectiveness of the device in providing consistent and reliable oxygen delivery during a live animal experiment.

Applications

- Single ventilator platform, capable of supporting the various treatment paradigms during a potential COVID-19-related hospitalization, or other

emergency uses

Advantages

- One-device-one-visit solution that is sufficiently robust to accompany a patient through all respiratory aspects of COVID-19 treatment
- Rapid and high-volume manufacturing due to small number of associated parts
- Constant pressure monitoring to detect leaks or obstructions that could risk patient or device safety
- Spirometer-based expiratory volume sensor in exhalation circuit to measure exhaled volumes and assist in determining patient volume calculations and settings

Publications

- Raymond SJ, Wesolowski T, Baker S, et al. A low-cost, rapidly scalable, emergency use ventilator for the COVID-19 crisis medRxiv. 2020. Doi: 10.1101/2020.09.23.20199877

Patents

- Published Application: WO2021195466

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