

The MIT mechanical ventilator project @ OOSEH.com

The purpose of my posting this “TwinDrive” design concept for a respiration assist device on my personal website ([www.ooseh.com](http://www.ooseh.com)) is to help the world with an open source ventilator concept. Engineers & manufacturers around the world should work together to modify the *TwinDrive* design for their specific manufacturing constraints and create the controls to meet their own operational needs. The devices should be used under the care of a medical professional. At the same time I hope to provide a fresh breath of air to the issue of climate change and how the human race can walk away from sadness to happiness: one over sadness equals happiness!

### **Background**

On March 12, 2020 my lab started working on mechanical respiration assist devices in response to the upcoming shortage of ventilators created by the COVID-19 pandemic. To proceed rapidly, only one of the designs is being presented on the MIT website. The website (<https://e-vent.mit.edu/>) provides open-source what we have been finding, developing and testing. The *TwinDrive* design concept is not yet built/tested and will require more sophisticated controls but is mechanically simpler; hence I felt it is important to release this to the world ASAP. The *TwinDrive* system is designed to operate using high torque low speed gearmotors from automotive windscreen wipers (readily found in autos and light trucks) that could directly actuate “hands” that squeeze an ambu bag to ventilate a patient according to a cycle a physician would specify. Thus, the TwinDrive design is optimal to regions of the world where “geared design” is suboptimal due to limited manufacturing resources.

### **Design Spirit**

For any system, the key is the cycle of inspiration, e.g., 0.4 seconds to inhale for 30 bpm; and the high force needed to squeeze the bag (up to 90N on each hand). It is also important to squeeze the bag from both sides to keep the hoses from moving (and straining) and to minimize rubbing on the bag. At MIT we first showed how to build a single motor “bottom drive” where a Gearmotor’s pinion engages one gear concentric with the axle of one “hand.” The same gear engages an identical gear on the opposing hand. This sort of gear-driven hand closer is common on many robot grippers.

### **Path Forward**

By providing the solid model files and design spreadsheet on my own website [www.ooseh.com](http://www.ooseh.com), I hope to speed up the design and test process with help from the world so *Team Human* can create a world-design. The mechanical design plus controls (that need to be developed) could be created and tested rapidly and shared. As developments do occur, they can be accommodated on the e-vent.mit.edu website for example. But there is another reason I am putting the design here as opposed to on some other open source design website, and that is there is a much bigger crisis we face...

What happens after COVID-19? Or the next pandemic? We humans have gotten so good at biology and mapping genomes that we are coming to expect that we can “easily” create a new molecule in the short term fix any disease problem that arises. Thus as people

I worry that while good and getting better at addressing sudden problems that arise, our overall

short term focus is preventing us from as a species focusing on the real threat to our survival: climate change. Our climate is inevitably changing which will dwarf all pandemics because pandemics come and go, but climate change will wipe out not only vast swaths of humanity, but vast swaths of where we live. The transition is happening slowly like dust gathering on furniture; the cumulative result may be by far the biggest challenge we face as a species.

I have been thinking about climate change and how we can all benefit in many ways, including economically, from changing our ways to address climate change; and I have create a series of poems with accompanying images that I hope convey critical issues and potential solutions. Please share these with others, discuss, evolve, add to them, and lift the conversation to community leaders and elected officials.

This does NOT have to be a zero-sum game, as thermodynamics says we can all have more if we just focus on using the energy continually coming to the planet from the sun (solar and wind). The answers my friends are shining brightly and blowing in the wind as long as we remember

