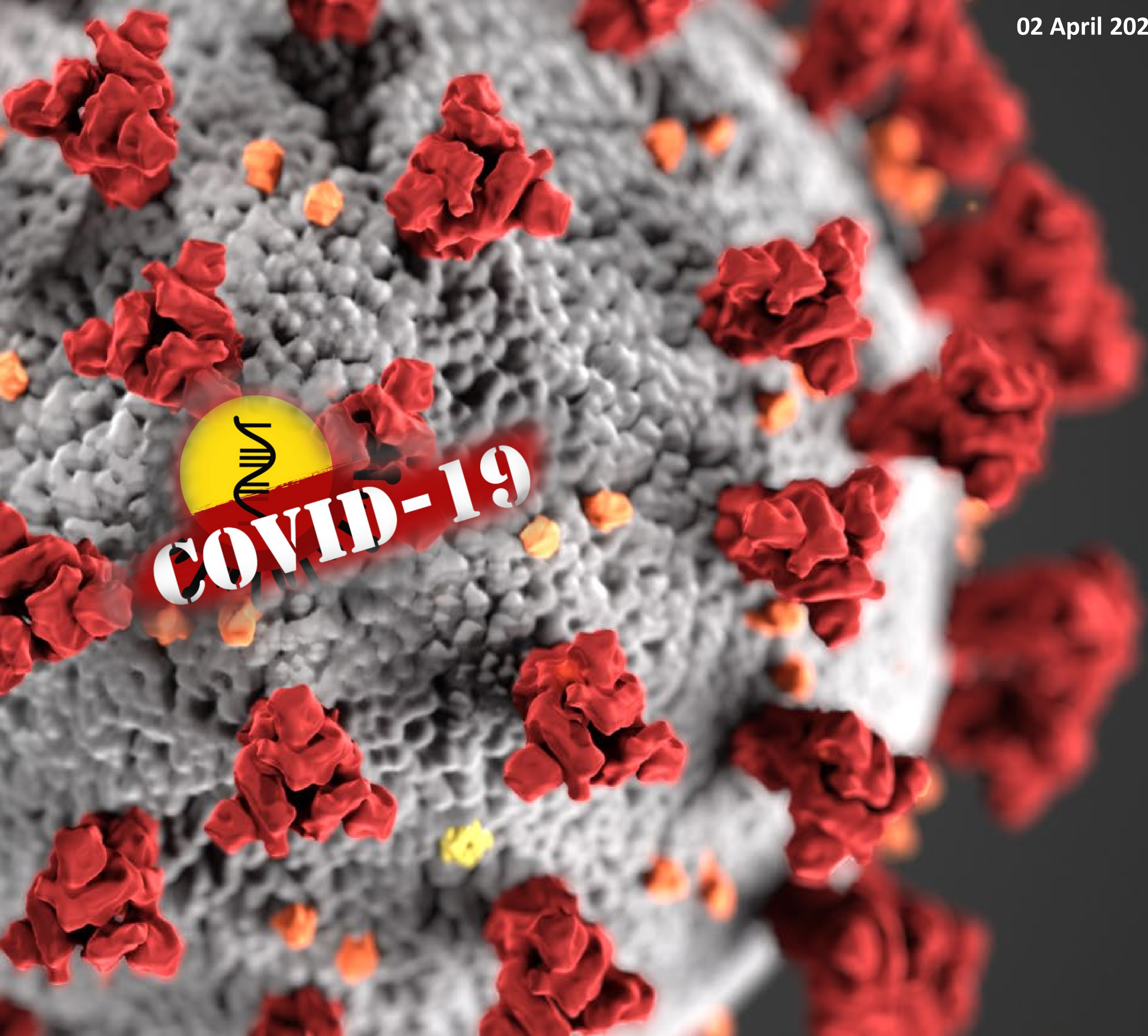
02 April 2020



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Your safety in mind

COVID-19 Response

WAR AGAINST COVID-19

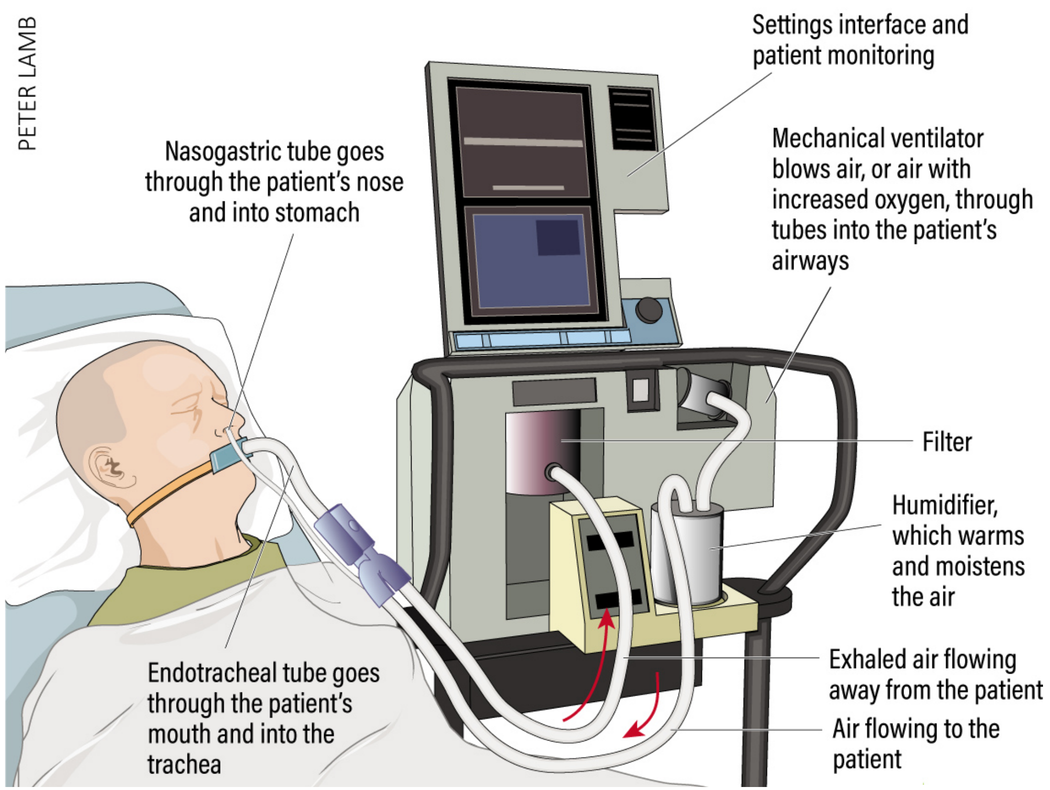
VENTILATOR

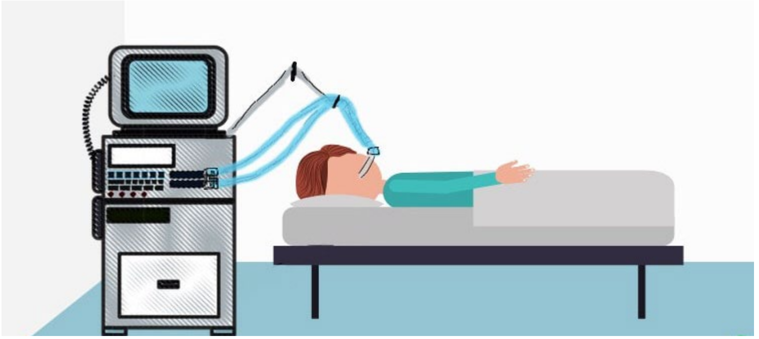
1. **Mechanical ventilation**, or **assisted ventilation**, is the medical term for artificial ventilation where mechanical means are used to assist or replace spontaneous breathing.[1] This may involve a machine called a ventilator, or the breathing may be assisted manually by a suitably qualified professional, such as an anesthesiologist, Registered Nurse, respiratory therapist, or paramedic, by compressing a bag valve mask device.

2. Mechanical ventilation is termed "invasive" if it involves any instrument inside the trachea through the mouth, such as an endotracheal tube or the skin, such as a tracheostomy tube. [2] Face or nasal masks are used for non-invasive ventilation in appropriately selected conscious patients.

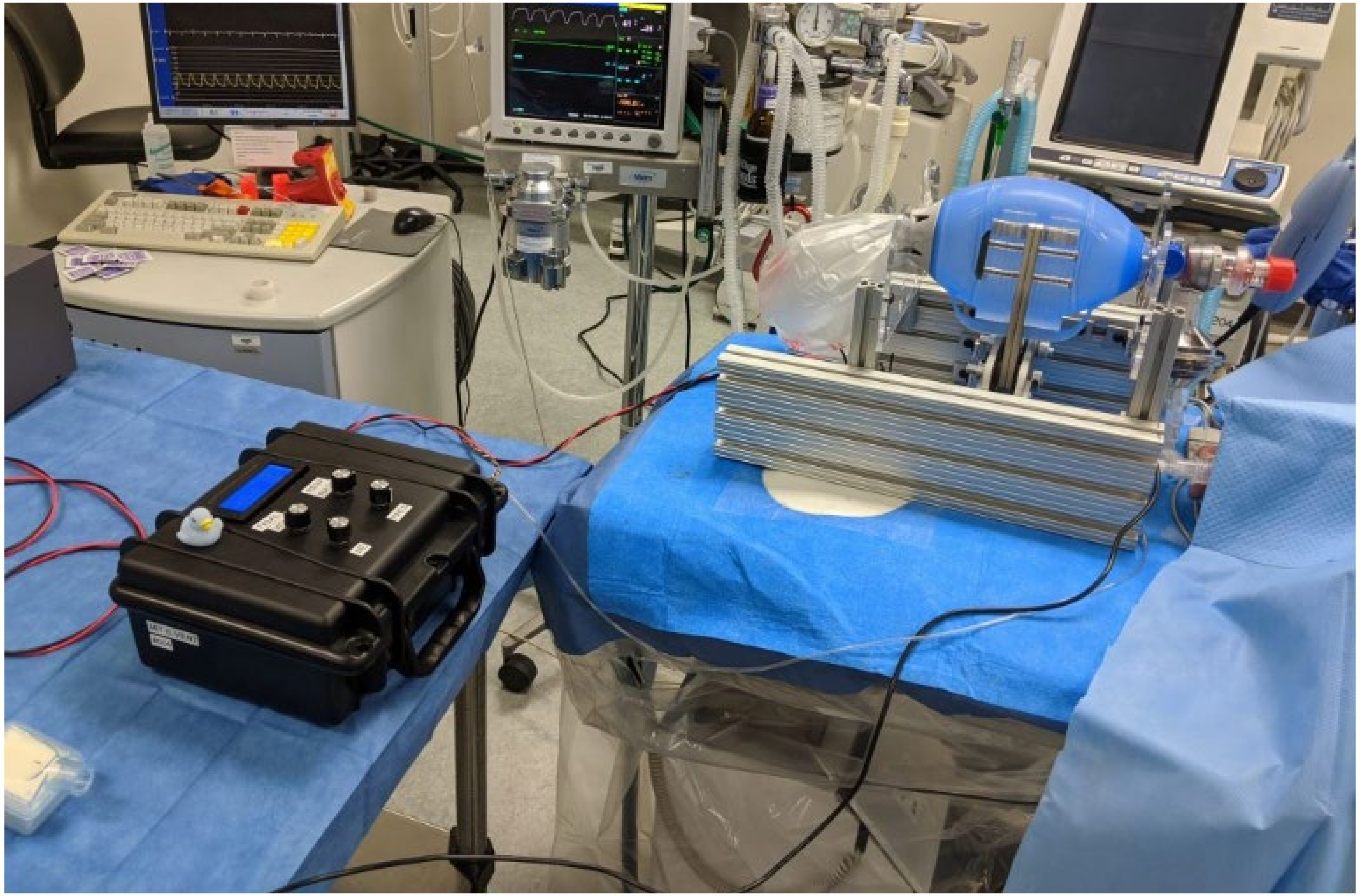
3. The two main types of mechanical ventilation include *positive pressure ventilation* where air (or another gas mix) is pushed into the lungs through the airways, and *negative pressure ventilation* where air is, in essence, sucked into the lungs by stimulating movement of the chest. Apart from these two main types, there are many specific modes of mechanical ventilation, and their nomenclature has been revised over the decades as the technology has continually developed. The shortage of ventilators have emerged as a key aspect of the Coronavirus pandemics.

Figure I. Mechanical ventilator for positive pressure ventilation





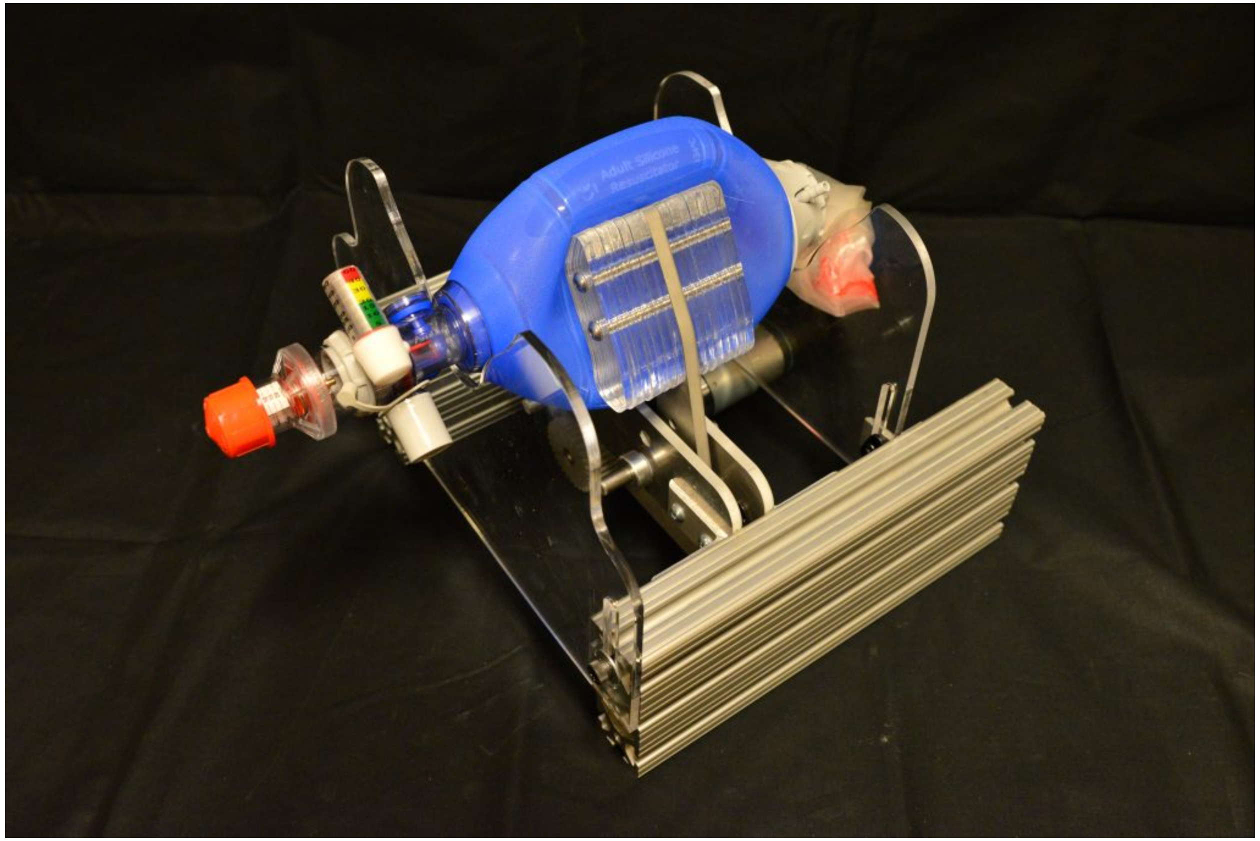
MIT Rapid e-VENT Project - https://e-vent.mit.edu/

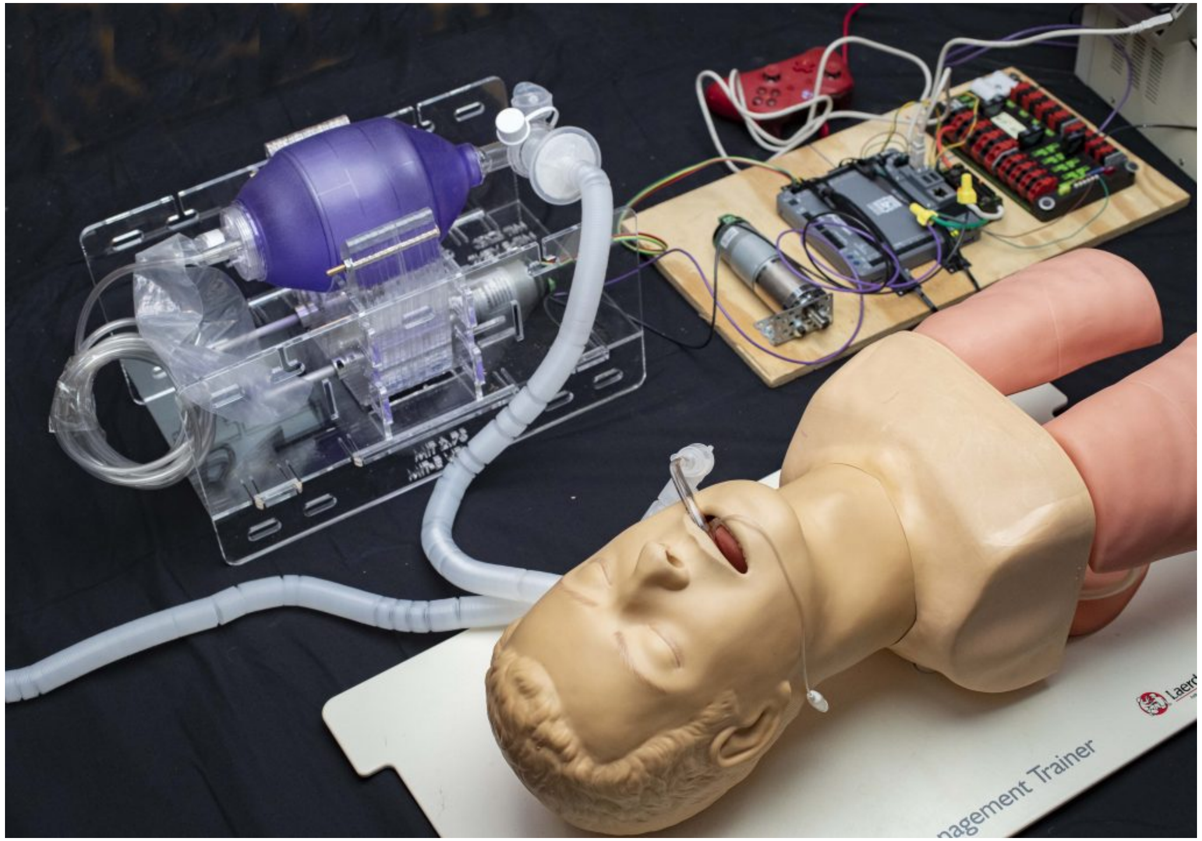


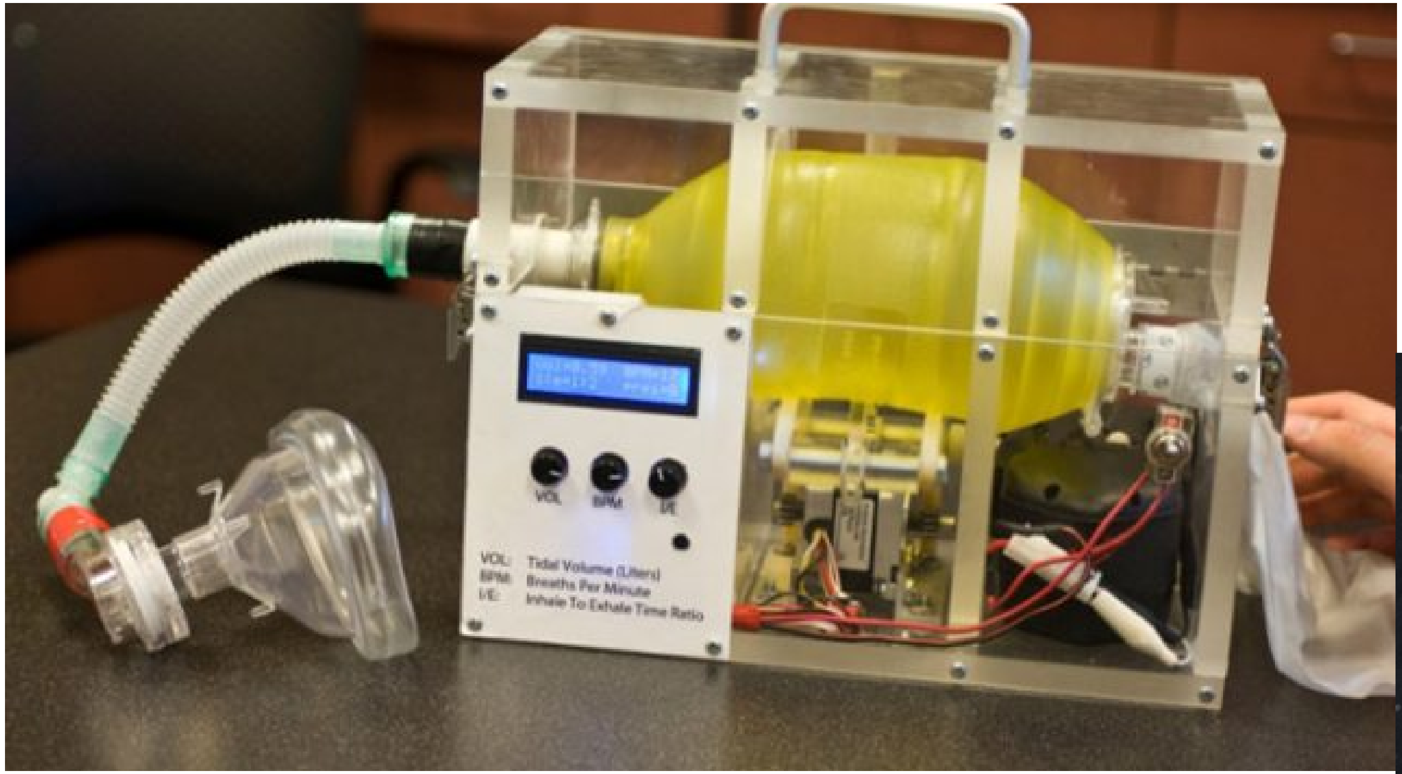
MIT E-Vent Unit 002 Undergoing Testing, Image by MD

We are one of several teams who recognized the challenges faced by Italian physicians, and are working to find a solution to the anticipated global lack of ventilators. In the US alone, the COVID-19 pandemic may cause ventilator shortages on the order of 300,000-700,000 units (CDC Pandemic Response Plans). These could present on a national scale within weeks, and are already being felt in certain areas. An increase in conventional ventilator production is very likely to fall short and with significant associated cost (paywall warning). Almost every bed in a hospital has a manual resuscitator (Ambu-Bag) nearby, available in the event of a rapid response or code where healthcare workers maintain oxygenation by squeezing the bag. Automating this appears to be the simplest strategy that satisfies the need for low-cost mechanical ventilation, with the ability to be rapidly manufactured in large quantities. However, doing this safely is not trivial.

MIT E-Vent Setup

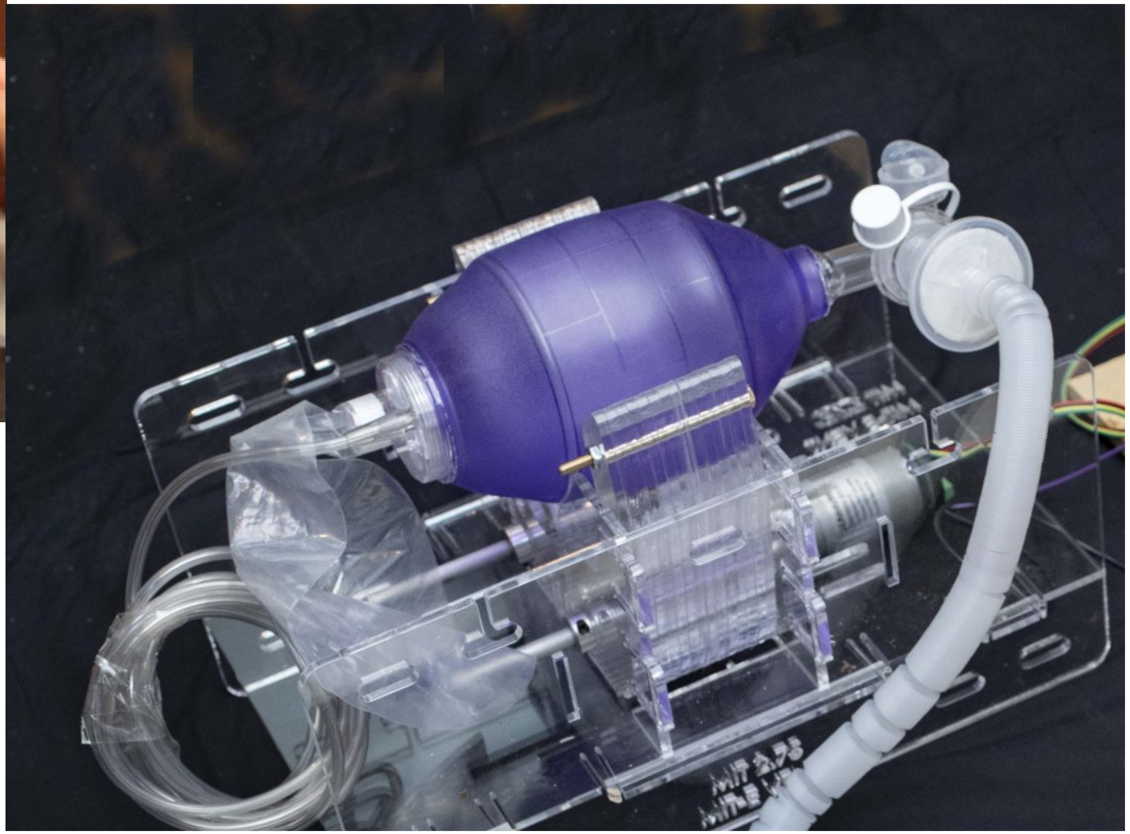


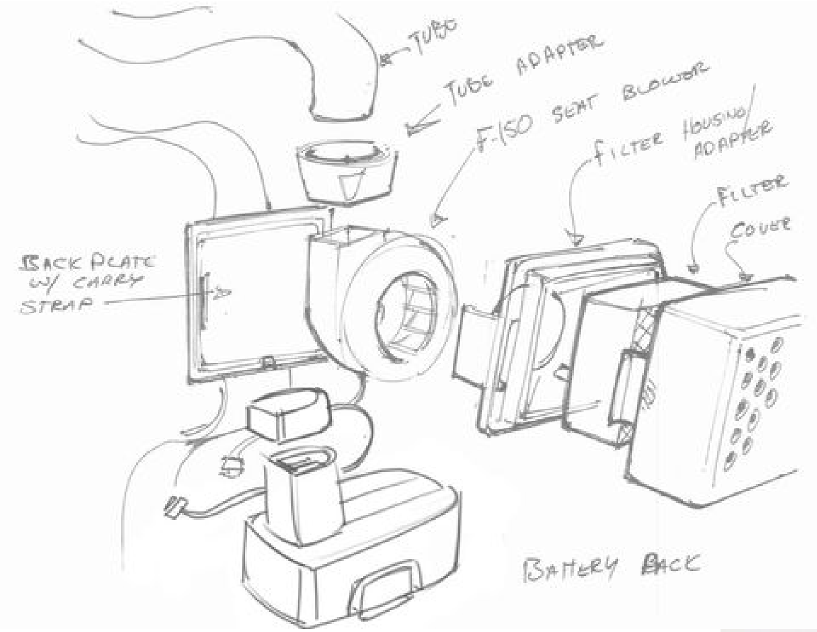


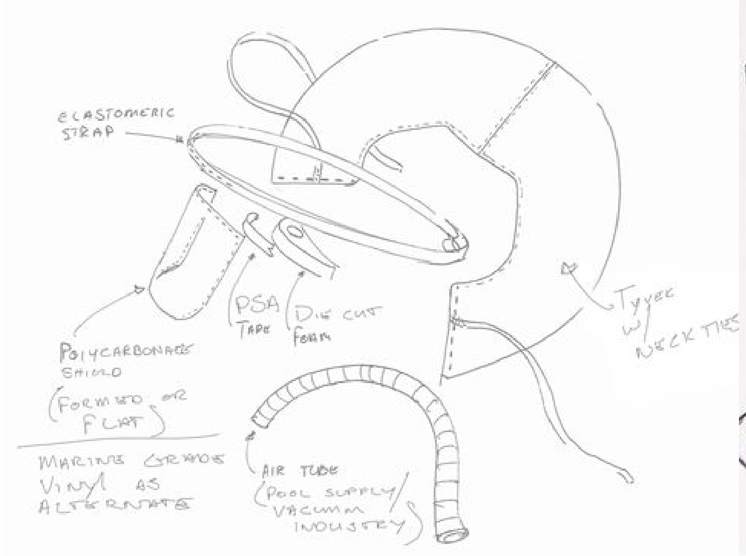


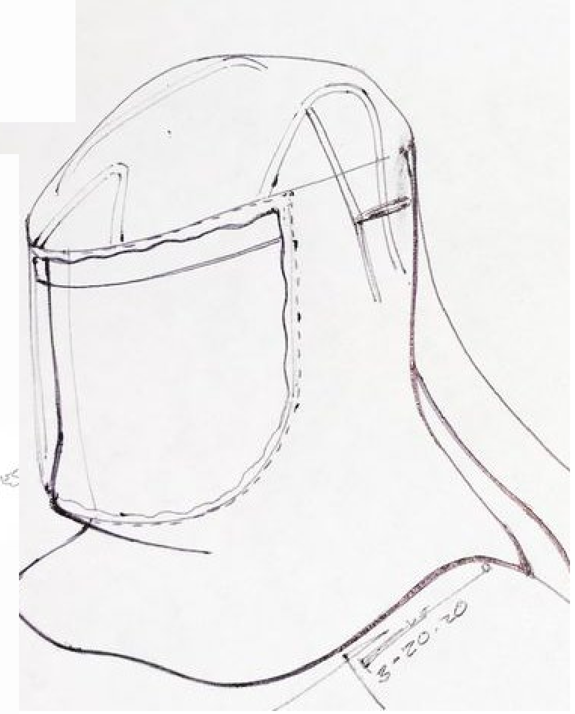
Old paper written in 2010 by MIT graduate student

https://e-vent.mit.edu/wp-content/uploads/2020/03/DMD-2010-MIT-E-Vent.pdf









Ford announced today that it is partnering with 3M in order to manufacture powered air-purifying respirators (PAPRs) as part of its response to the COVID-19 pandemic. These respirators are often called positive-pressure masks as they take contaminated air, pull it through a filter, then push it to the sealed mask using an air blower.

Ford will assist by providing components from their parts bin to build the respirators. The design released by Ford (top) will use 3M filters that draw air into a blower motor sourced from an F-150 and then pushed through a tube up to a mask that is sealed to the user's face.

The blower motor is sourced from the F-150's front seat assembly and is usually employed as part of the ventilated seat option. These motors are compact and run on 12 volts in the car, so they can be used with a battery pack in a situation where they need to be portable.

Seat blower motors may not seem like the first choice, but they are actually matched quite well to the blowers that are usually present in these types of respirators. According to Delta Group, seat blowers can operate at 9 to 16 volts while drawing around half an amp. This allows them to produce between 14 and 19 cfm of airflow.

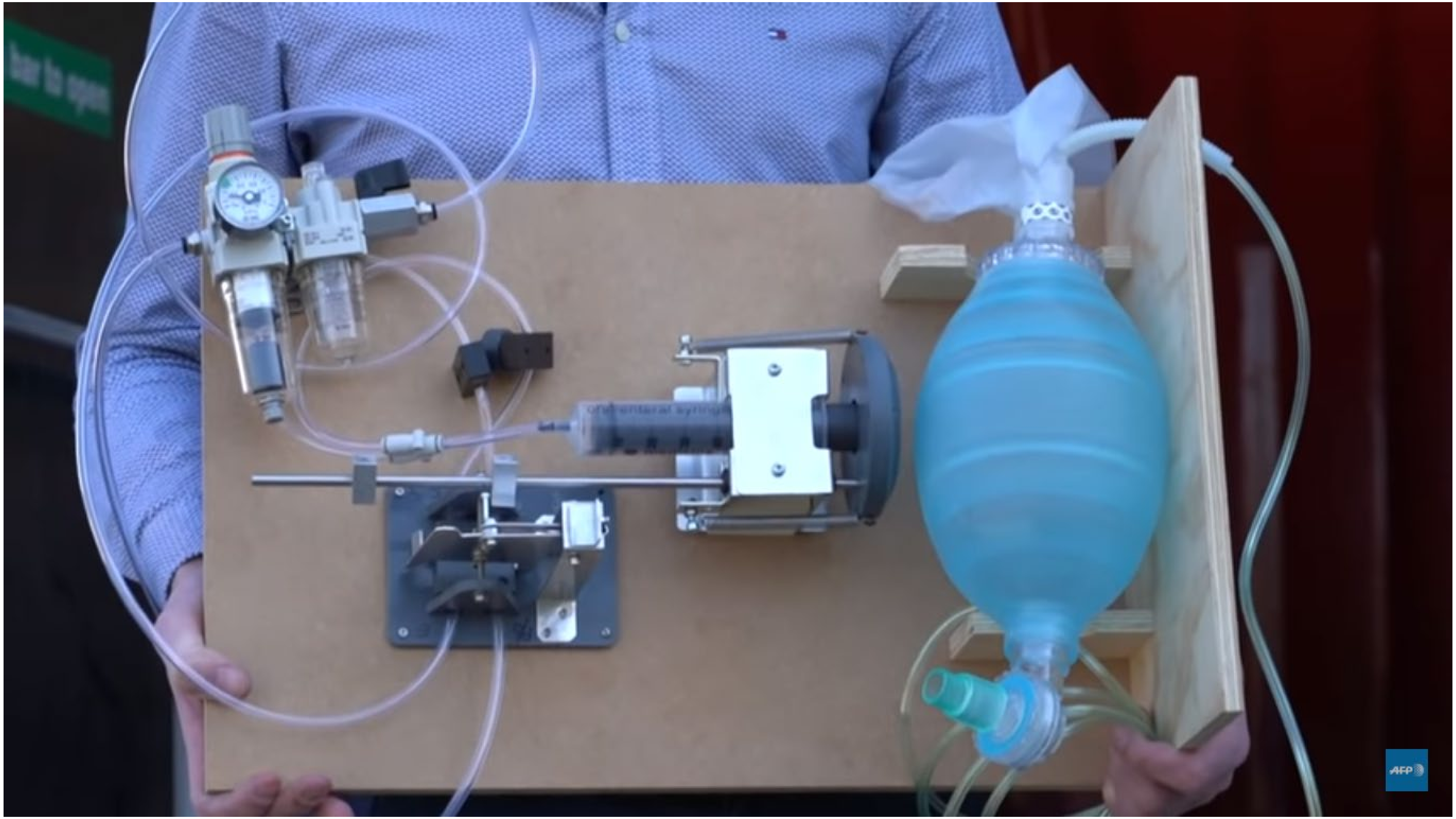
In comparison, the motor inside the 3M TR-800 system produces between 6.7 and 7.8 cfm depending on the setting, making the seat blower a very close match. The seat blower's power can be adjusted via a variety of methods–like PWM control–in order to bring it down to the same level of airflow as the purpose-built respirator blowers.

This air flow rating is also partly why blower motors used for the primary HVAC systems in cars would not be a good choice. These units can produce hundreds of cfm of airflow. Size is also a factor. Seat blowers are usually around 3x3 or 4x4 inches wide and less than an inch tall. A primary HVAC blower motor is often 6x6 inches wide and over six inches tall.

Ford is planning to use power tool batteries to operate the respirators. Based on their sketches, it looks like they will use something similar to the Dewalt DC9071 12-volt. This battery is rated at 2.4 amp hours, which allows us to get an estimate of run time using the Time = Current/Amps formula. In this case we would take the 2.4 amp hours and divide it by 0.5 amps from the blower rating above to give us a rough run time of a little under five hours.

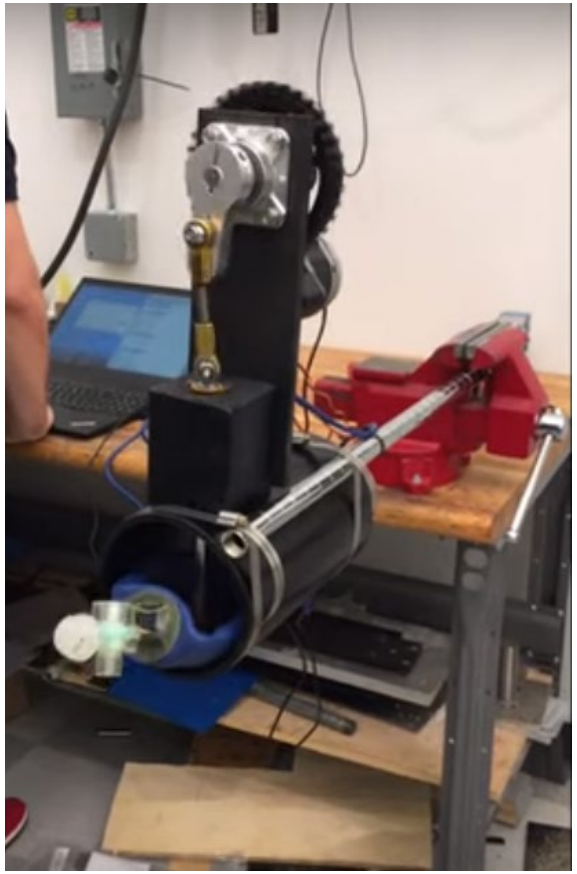
Since these blowers would only need to run at half speed, it is possible that the run time could be doubled, extending it all the way up to 10 hours. These numbers would be comparable to the purpose-built respirator battery packs which range from four to six hours for standard units and eight to 12 hours for high capacity units.

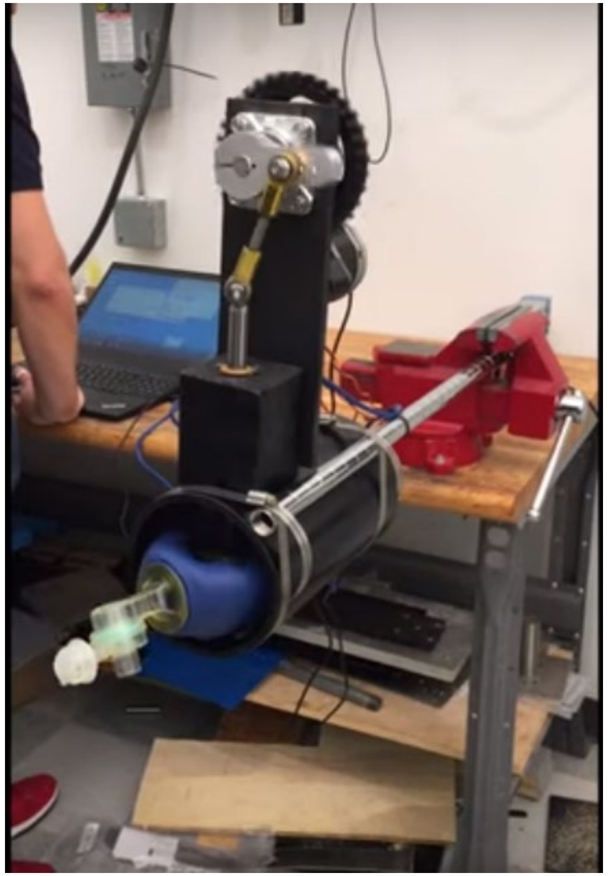
GTECH Solution - https://www.youtube.com/watch?v=DdQg11QgpXg&feature=youtu.be

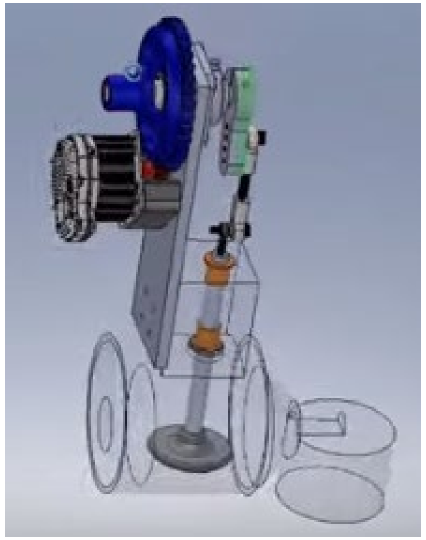


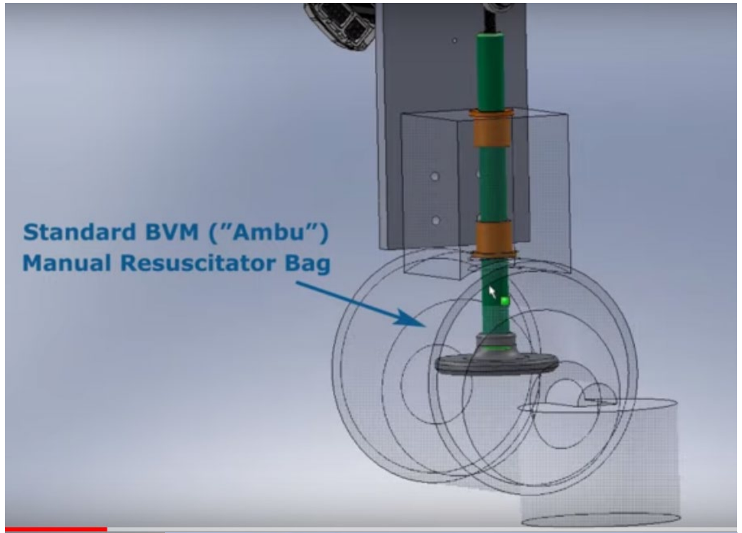
Pure Mechanical Prototype

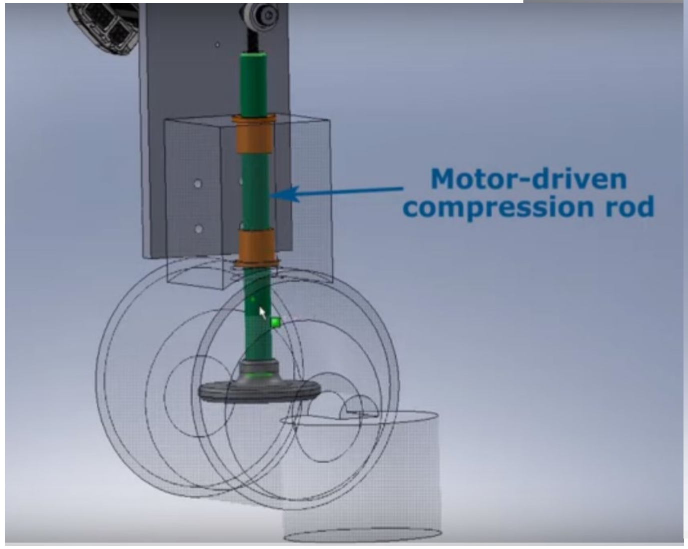
https://www.youtube.com/watch?v=3ssVoWEVxw4&feature=youtu.be

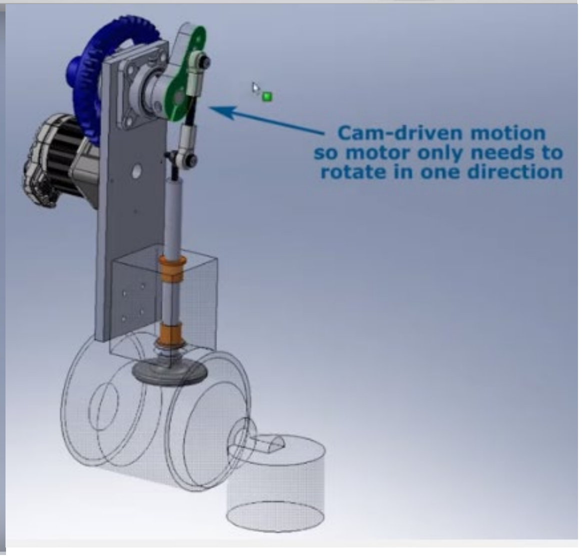








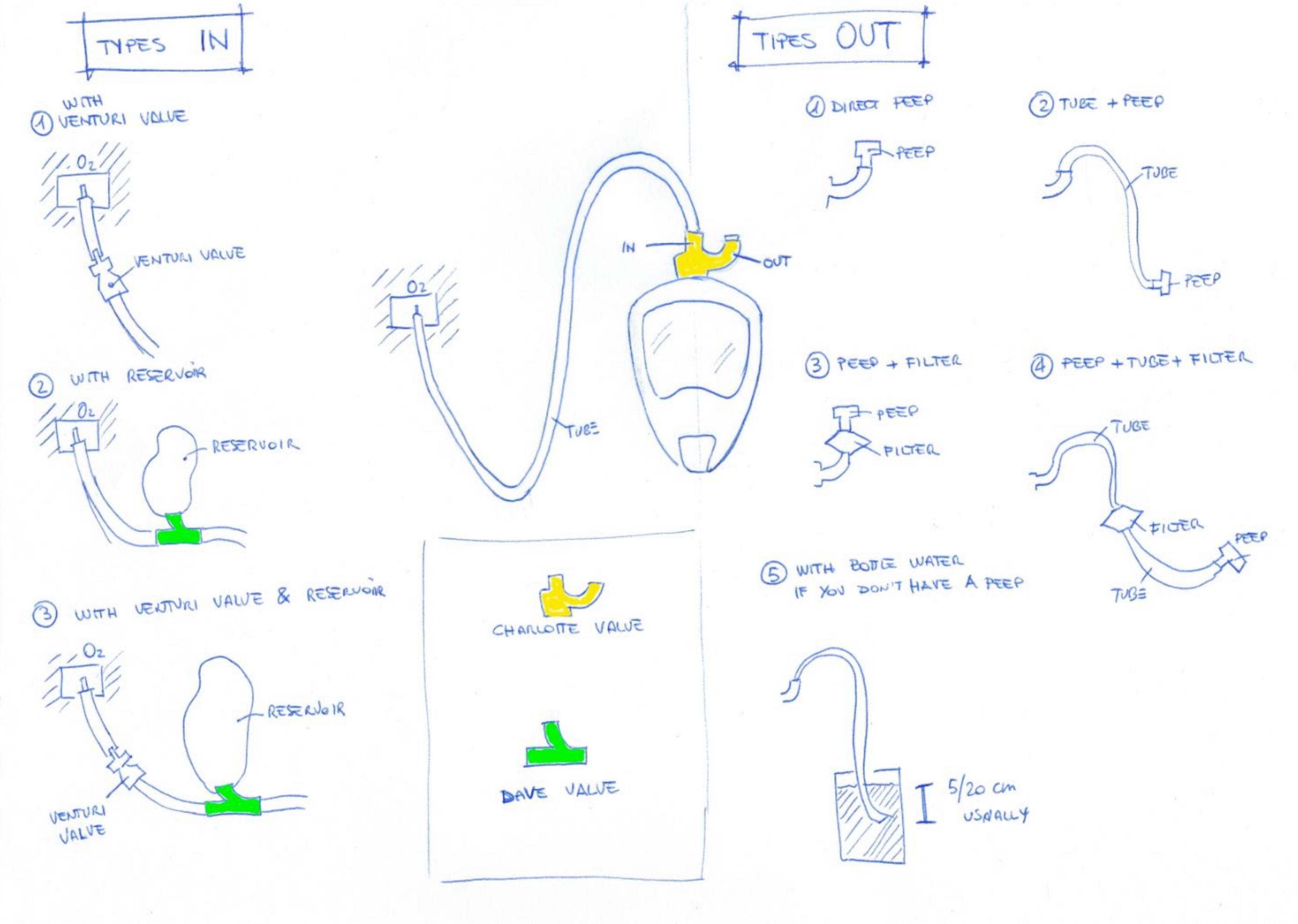




https://www.youtube.com/watch?v=RpEqtGa2vTI&feature=youtu.be

Isinnova shares 3D printed adapter to turn snorkeling mask into a non-invasive ventilator

https://www.3dprintingmedia.network/isinnova-shares-3d-printed-adapter-to-turn-snorkeling-mask-into-a-non-invasive-ventilator/



https://www.3dprintingmedia.network/forums/topic/charlotteDownload 3D STL File for 3D Printing: -valve-by-isinnova-for-non-invasive-ventilator/

Windscreen Wiper Motor – Into Ventilators - https://sifted.eu/articles/coronavirus-windscreen-ventilator/

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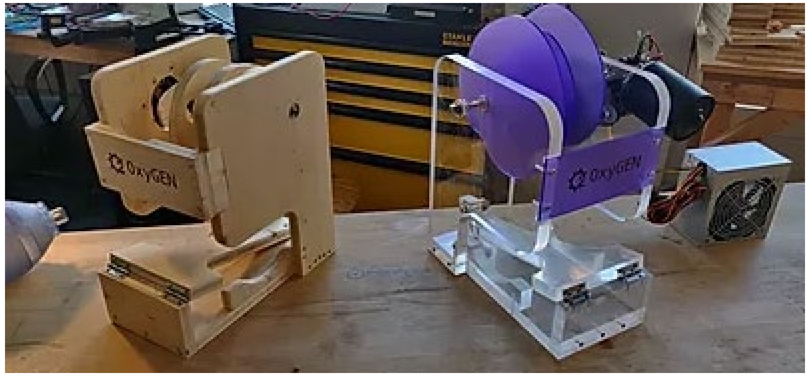
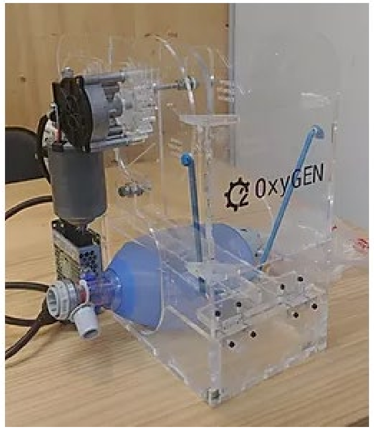
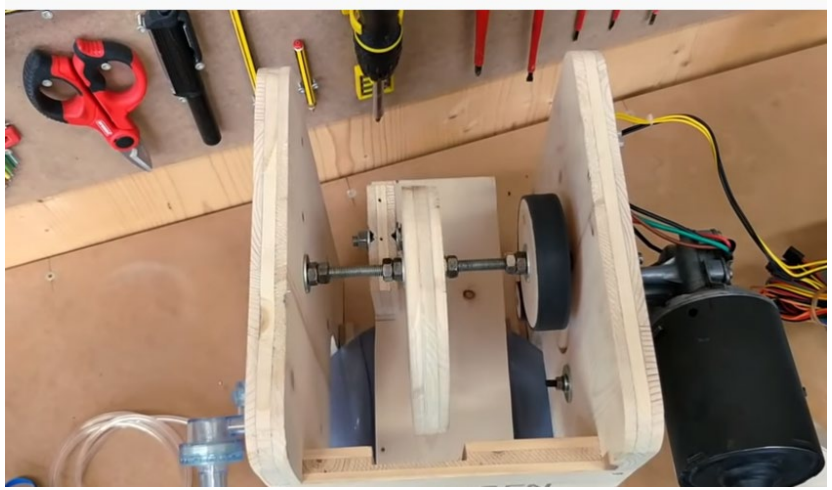
https://www.youtube.com/watch?v=0386hOgcQTA&feature=youtu.be

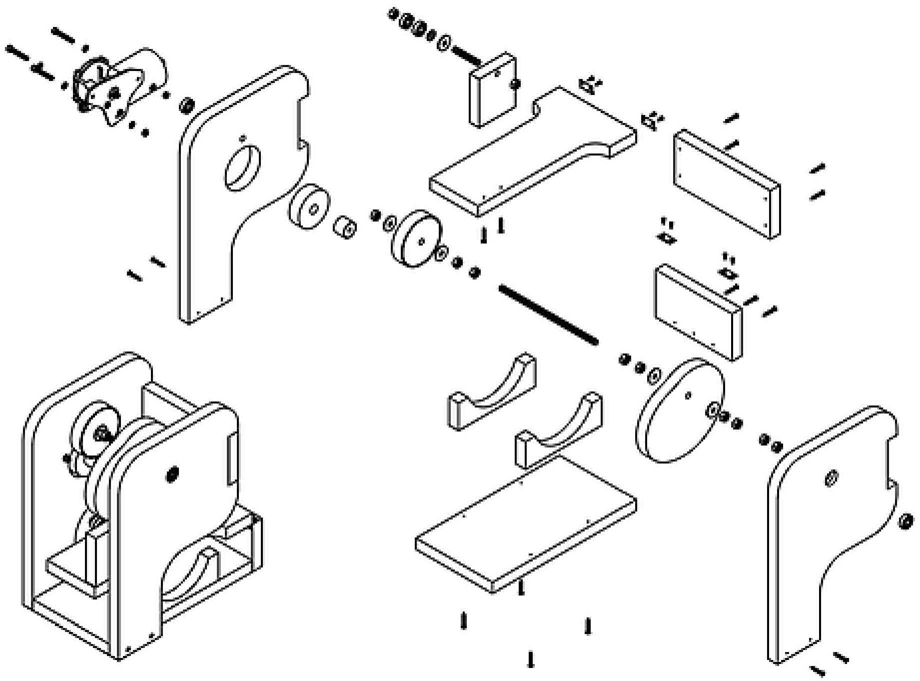
https://www.facebook.com/Oxygen-Project-103423307962632







Repository and download



View repository

Download

Download :

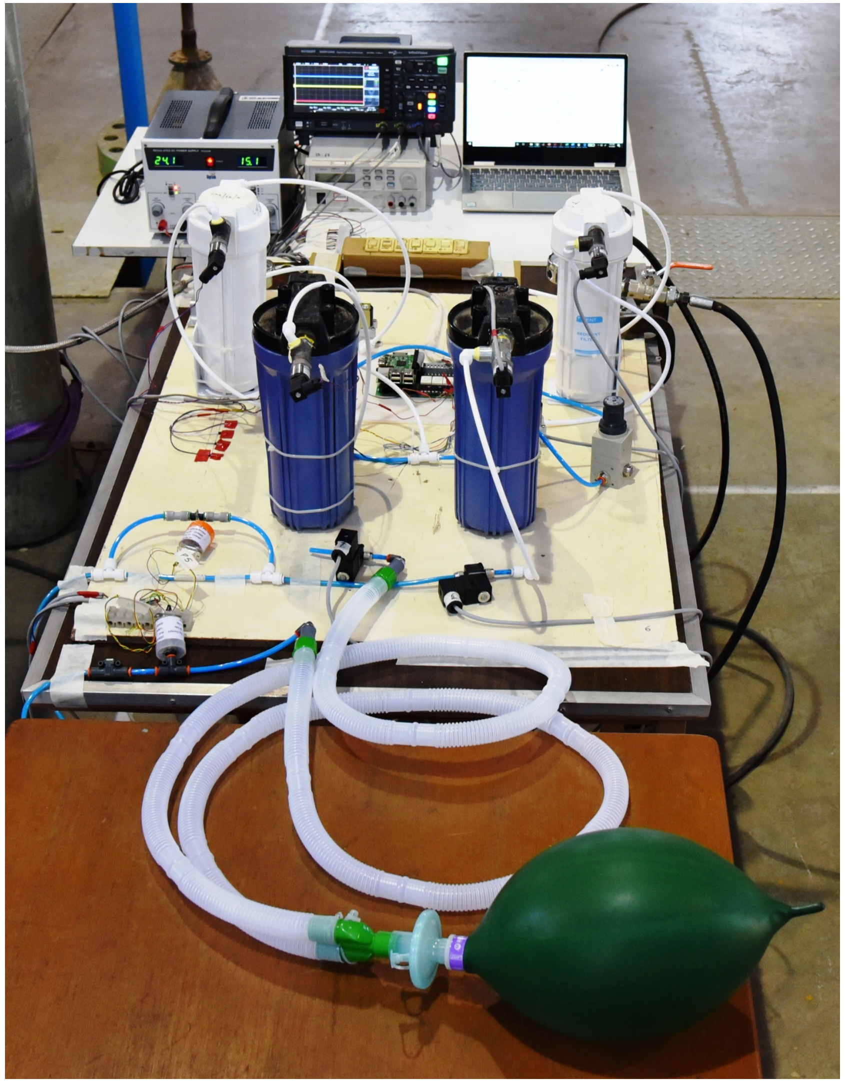
https://www.oxygen.protofy.xyz/?fbclid=IwAR04YPQ9gzQrMuUZ_BlGrd2-qXaC-y-XSgoNxKPXZz0y-iPBTJ_i-M7rJyM

https://github.com/ProtofyTeam/OxyGEN/tree/master/3DFiles/v1.0

3DFiles/v1.0	Initial commits -> We're working to give more info
Matlab Files	Matlab files
V5	Add List of materials for V5

IISc team building indigenous ventilator prototype for COVID-19 patients

https://iisc.ac.in/events/iisc-team-building-indigenous-ventilator-prototype-for-covid-19-patients/



"For the last 10 days, we have been working day and night to get this technology going," says Gaurab Banerjee, Associate Professor at the Department of Electrical Communication Engineering and one of the project coordinators. "We hope that by the end of April, manufacturers can have their own prototypes done, which they can scale up very quickly."

A well-designed ventilator has built-in sensors and actuators that allow doctors to set the volume and pressure of gas delivered to the patient precisely, which depends on the severity of their illness. But many ventilator components are currently not manufactured in India. This prompted the IISc team to build some components and co-opt others. To store and mix air and oxygen, for example, they simply reused sedimentation tanks found in household RO water purifiers. "The mixing process that we have come up with has parallels to those in gas turbines and industrial burners, where the ratio of fuel and oxidizer is carefully controlled," says team member Pratikash Panda, Assistant Professor at the Department of Aerospace Engineering.

For any queries about IISc press releases, please write to news@iisc.ac.in or pro@iisc.ac.in.

A bench-top test setup assembled at the IISc high-speed wind tunnel complex to experimentally test ideas and concepts during the ventilator prototype development phase. A "test lung" (seen on the bottom right of the image) is used in these experiments to roughly mimic a distressed human lung. (Test lung courtesy of Narayana Hrudayalaya).

OUR VENTILATOR SPECIFICATIONS.
YOUR INGENUITY.

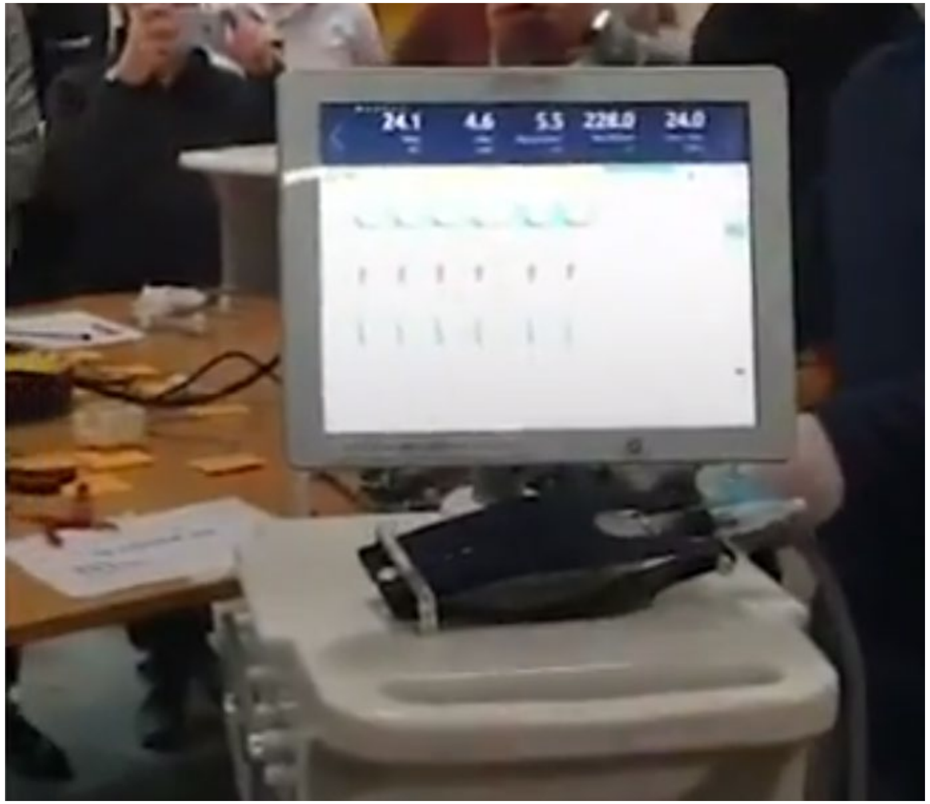
We all are facing an unprecedented challenge. Medtronic is working around the clock to manufacture ventilators and to create new solutions for increased ventilator production.
Medtronic publicly posted design specifications for the Puritan BennettTM 560 (PB560) to allow innovators, inventors, start-ups, and academic institutions to leverage their own expertise and resources to evaluate options for rapid ventilator manufacturing. Medtronic's goal has been to release this information in phases over the course a brief period.
To aid in the manufacturing evaluation, Medtronic first prioritized sharing the hardware design specifications and manufacturing instructions.
Next, on March 31, Medtronic posted additional ventilator design documents, including manufacturing fixtures, printed circuit board drawings, multiple bills of materials (BOMs), and 3D CAD files.
On April 1, Medtronic posted software source code files.
Medtronic is targeting providing final packages of documents with additional BOMs and other information by April 3.
Thank you for your patience as we roll this extensive information out during this critical time and we thank you for your interest in addressing the critical need for ventilators.
To access the specifications, please register below. After you do, you will be redirected to a new page on medtronic.com to download the files. Note that all documents and guidance are subject to the provisions and restrictions contained within the assets being provided.
Thank you for your interest in using innovation to save lives. Together, we can help speed the development and production of this important technology.

Register here and download all design files
https://www.medtronic.com/us-en/e/open-files.html

https://open-source-covid-19-ventilator-canada.mn.co/

The Turkish aerospace firm designed using composites

Innovative / opposite to all other designs - normal is closed Ambu / oxygen pressure opens it and the closure of valve stops oxygen flow and hence pressure and so the metal/carbon composite sheets press the Ambu bag thus injecting the oxygen into the patients lungs



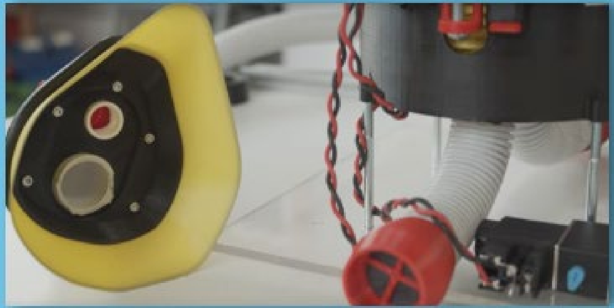
https://youtu.be/ooacY0O1OGk

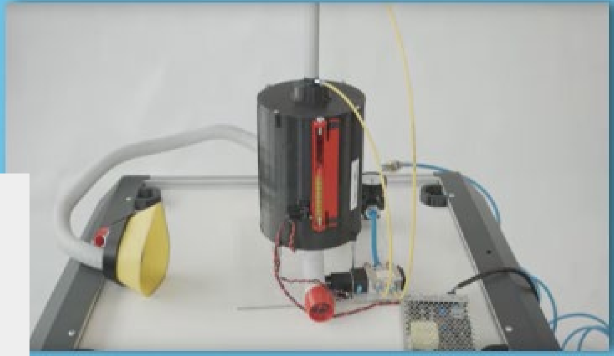
Poland-based VentilAid project 3D prints open-source ventilator

https://www.ventilaid.org/

File Download

https://gitlab.com/Urbicum/ventilaid





Open-source ventilator, that can be made anywhere locally.

The last resort device.

Tested. Reliable. Need constant access to compressed air.

Possibility regulation: air amount, in and out air filtration, air humidification, breathing rate, pressure.

3D printed parts: 15 hours of printing. PLA /ABS and TPU/Flex material. Reliable if well printed.

Industrial parts:

Pneumatic actuator with 10-20 cm stroke. Very reliable.

Pneumatic limit switch or electric limit switch with check valve and 12VDC power supply. Very reliable.

WE CREATE A VARIETY OF VENTILATOR PROJECTS

PRODUCED INSTANTLY AND LOCALLY

3D PRINTER AND ESSENTIAL COMPONENTS NEEDED ONLY

CAN BE PRODUCED IN EMERGING REGIONS OF THE WORLD

WE SHARE GOOD KNOWLEDGE AND USEFUL INFORMATION

ONLY TESTED PROTOTYPES

ONLY PROFESSIONAL AND EXPERT KNOWLEDGE

ONLY SIMPLE AND EFFECTIVE DESIGNS

AgVa Ventilator Comparison

Specs	AgVa Ventilator	Competitors
Tidal Volume	50-2000 ml	50-2000 ml
Peak Pressure	60 cm H2O	60 cm H2O
Battery Backup	3 Hours	4 Hours
Consumable cost per patient	Rs. 500	Rs. 3200
Expiratory Flow sensor Cost	Rs. 300	Rs. 7000
Expiratory Valve Cost	Rs. 200	Rs. 5000
Running Power	20 watts	60 watts
Modes	PC-CMV PC-SIMV VC-CMV VC-SIMV PRVC PSV SPONT CPAP BPAP	S(CMV) SIMV PC-SIMV SPONT ASV
Warranty	2 Years CMC	2 Years without CMC
Price	1/7 cost of competitor	Rs. 10Lakhs +

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Your safety in mind

COVID-19 Response

For Additional Details

tceconnect@tce.co.in

SUBJECT: URGENT COVID RELATED EMERGENCY SUPPORT REQUEST