March 31, 2020

To the Agorize Technical Expertise Panel,

As the worldwide pandemic of COVID19 brings the world's healthcare resources to its upper limits, governments and healthcare institutions have sought alternatives to mitigate these capacity issues. Recognized early as a significant bottleneck to adequate delivery of care to critical patients was the need for equipment for ventilatory support. In the months and weeks since COVID has made landfall in North America, and a dawning of the realization that Canada will not escape its pandemic unaffected, numerous independent groups have been struck to address the potential ventilator shortage. While ventilator manufacturers continue to ramp up production as best they can, these independent developers have eventually converged on designs which leverage a bag-valve-mask (BVM) type of arrangement. While our group has continued work on a version of the BVM, members of the team have conceived of a completely novel design which obviates the requirement for electrical motive power and which includes full functionality per the UK MHRA guidelines.

The use of water seals has been observed in medicine for treating pneumothoracies, for paracentesis, and many other areas since the advent of medicine in the 1800s. Only with developments in machining and miniaturization has this basic principle been abandoned in favor of other technologies. With the rediscovery of the waterseal principle in our gVent, while leveraging mechanical principles of design, the team has created an entirely novel ventilator which is primarily pneumatic and mechanical in nature, therefore highly resistant to outside forces and infinitely tunable across all ventilatory parameters. Respiratory rate, tidal volume, I:E ratio, peak and plateau pressures, and PEEP can all be dialed in mechanically, and therefore are not subject to computer failures, electrical failures, and inadvertent settings changes. Infection control is trivial in light of known water treatment strategies, which again is a significant consideration when deployed in hostile settings.

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In principle, the gVent could be constructed from highly available materials in almost any scenario, making it imminently usable in low resource environments such as disaster relief, pandemics, and developing countries. The lack of requirement of electrical power further supports the utility of this unique design, as does the fact that being a simple mechanical machine, it can be manually powered to support patient breathing in real time as backup. The gVent has been constructed with plastic buckets, sandbags and irrigation fittings, to demonstrate the versatility of options in its deployment. Estimates for materials for construction range from $25 to $500. With very few moving parts, and based on gravity as the driving force, the gVent is highly durable and able to accommodate a very high unsupervised duty cycle during its lifetime of service.

In summary, the gVent is a novel, fully-functional, gravitationally driven, low cost ventilator which is simple to source and easy to assemble. It is a highly reliable system, which can be quickly scaled for production in emergency ventilation roles in hostile environments.
Sincerely,

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