(i) **Title:** A Variable Bi-pressure Valve Design for a Flow-inflating Resuscitator

(ii) **Background Information (Problem Description):**

Adequate pulmonary gas exchange is a prerequisite for patient survival outside the rare circumstance of extracorporeal membrane oxygenation (a heart lung machine). It is not an usual clinical situation where patients cannot achieve adequate pulmonary gas exchange without medical intervention. This intervention is positive pressure ventilation through a resuscitator (see picture below). It is known that certain patients with inadequate pulmonary gas exchange because of common clinical disease states will have better outcomes with specific ventilation strategies, that certain pressure and volumes of delivered gas to the lungs[1-3]. For example the peak inspiratory pressure, the pressure which drives new gas into the lungs, and the end expiratory pressure, the pressure which the lung exhale against are important ventilation variable which need to be set to achieve optimal patient outcome.

When these patients need to be ventilated for a prolonged period of time, the most common method of achieving positive pressure ventilation is via a mechanical ventilator. That being said it is often that these patients must be transported, where manual ventilation is required[4], with ventilation achieved with a resuscitator.

There are numerous types of manual ventilators (or resuscitators) available, but in general terms they have a connection to the patient and a reservoir of gas[5]. The control of the delivered pressures is done through tactile control of exhaust orifice with compressing the gas reservoir. It may be the case that a valve connected to this orifice which can easily control both the inspiratory and expiratory pressure will more accurately control the actual delivered pressure to the patient when compared to the current standard of manual compression of the exhaust orifice. There are currently marked variable orifice valves which can control the end expiratory pressure, but no known valves that that easily control both inspiratory and expiratory pressures are currently available.
(iii) Objective(s):

To Design and construct a value which can be used with a manual resuscitator that can:

1) Accurately control inspiratory pressure over a range of 5 – 40 cm water
2) Accurately control expiratory pressure over a range of 0-20 cm water
3) Operate over a range of fresh gas flow of 5-20 liters / minute
4) Be easy to operate

(iv) Designed Output:

To have a light weight and easily used value to accomplish the objectives above.

References


