Tolomatic™
EXCELLENCE IN MOTION

OPEN SOURCE DESIGN CONCEPT

Automation of Manual Resuscitator ('Ambu' Bag)

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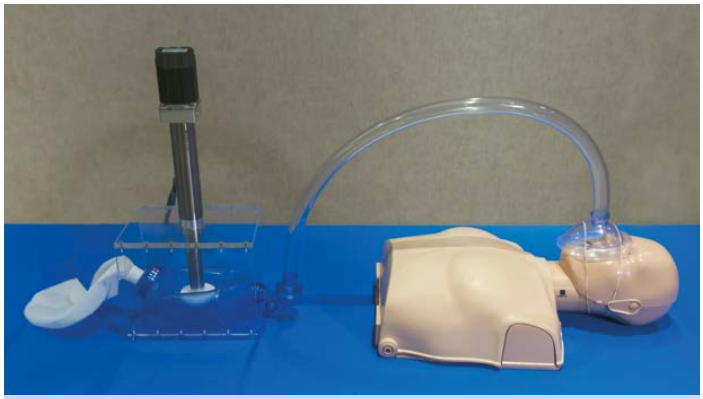
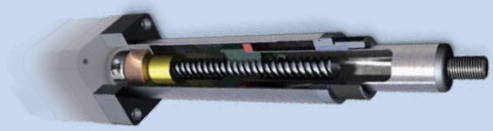
Tolomatic provides key products that support the operation of a wide variety of industries including essential businesses in food, medical, pharmaceutical, automation, and life sciences. We are doing everything we can to support the global fight against this virus including prioritizing all COVID-19 projects to the highest level possible.

The world's attention has been captured with the current COVID pandemic and the potential global shortage of ventilators. Tolomatic noticed a couple 'open source' design concepts that were posted on the internet. As a company focused on motion control solutions, we wanted to explore additional ways to mechanically actuate an 'Ambu bag'.





Cutaway view of Tolomatic ERD Rod Style Screw-drive Electric Actuator

Cutaway view of Tolomatic BCS Rodless Screw-drive Electric Actuator

Key Components:

- Medically approved manual resuscitator package and extended tubing (Ambu bag).
- Tolomatic linear actuator ERD (left) or BCS (right)
- Servo motor & drive
- Simple control solution
- Rod-end 'puck' for bag compression
- Box for holding the manual resuscitator and mounting the actuator

Benefits:

- Automating the manual process to enable non-invasive positive pressure ventilation for extended periods of time (days or weeks).
- Ability to quickly change out the manual resuscitator package for new patients.
- Ability to change not only the frequency of the induced respirations but also the volume. This is not possible with fixed displacement rotatory devices.

Automation of Manual Resuscitator ('Ambu' Bag)

We put our engineering, sales and operations team in motion, and had some ideas for new designs that would offer some advantages versus a simple motor and camming design or a pneumatic cylinder. Within one week we have created two concept designs that use screw driven linear actuators.

Both of these screw driven linear actuators convert rotary power from a servo motor into linear motion. This device now can control the velocity, the acceleration and the distance of any move at any point in time. Our mechanical device requires a servo motor, drive and some sort of control program. There would also need to be a user interface that could be done by knobs and switches, an HMI screen or a lap top computer.

Some unique ways that controlled linear motion brings to this normally manual means of ventilating:

- Complete control over the 'tidal volume' air flow to the patient. This would provide the ability to vary stroke length, vary the stroke frequency, and independently vary the speed of either down stroke or return stroke. This would allow adjustment for patients of almost all ages and sizes to get the proper amount of air.
- This is a robust solution offering reliable long life, and has the ability to integrate in some alarm features in case of motor faults or possible sensors around the airflow quantity and quality.
- Because of the controlled motion of a linear device, the linear actuator can provide air flow that is more similar to that of manual ventilation is more easily achieved
    - Without using complex software algorithms to adjust speeds and stroke lengths, cam-style designs produce diminishing levels of air flow at to the mid-stroke and then finish with a lot of air through completion of a compression cycle. (see the diagram)
    - Linear devices can quickly accelerate up to speed and maintain velocity over a commanded distance providing more continuous volumes of air per compression sequence, and a more typical breathing cycle.

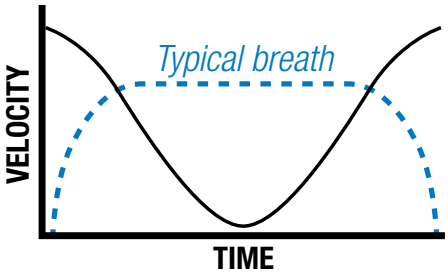


Figure 1: Motion profile of a cam style apparatus

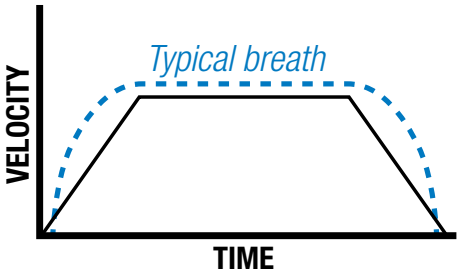


Figure 2: Motion profile of a linear style apparatus

The use of these motion concepts and proven industrial grade mechanical assemblies can be reliably used and further refined for both emergency medical use or in the development of next generation medical equipment.

Tolomatic is a leading US manufacturer of electric linear actuators, pneumatic actuators, and power transmission products, based in Minnesota. We stand ready to offer our motion control expertise to help solve critical challenges during this time.

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Call To Action… In an effort to support the global need for medical ventilators, Minnesota based Tolomatic has dedicated a team of engineers to the development of highly efficient emergency ventilator concept systems using electric linear actuators. The proposed technologies are the first step in making creative and reliable ventilators for patients around the world. Tolomatic’s hope is to spark interest and conversation with other potential partners in developing a final solution that can be submitted for approval.

LINKS…Tolomatic Covid-19 webpage, You Tube, Linked In, Twitter, FaceBook

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