Breathing Device

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Summary:

This project aims to develop a durable, scalable, and user-friendly breathing device that delivers controlled airflow while prioritizing safety, efficiency, comfort, and affordability. To achieve this, the design incorporates high- quality materials and optimized engineering to enhance performance and durability.

The final design includes:

- Ergonomic structure for user comfort
- Advanced airflow control system for precision
- Cost effective production methods to ensure accessibility.

Overall, the project successfully meets its objective by providing a safe, effective, and affordable breathing device that balances innovation and real-world usage.

Key Features	Benefit
Cost-effective material	Affordable without sacrificing quality
User-friendly	Simple and comfortable to use
Controlled Airflow	Ensures safe and efficient breathing
Positive User Feedback	Encouragement
Functional Prototype	Fully operational and reliable
Pilot Valve	Improves airflow control

Performance:

Bernoulli's with Darcy-Weisbach : $P_1 - P_2 = \left[\frac{0.8 f L_1}{g d_1^5} Q^2 + \frac{0.8 f L_2}{g d_2^5} Q^2\right]$

$1.547 \frac{lb}{in^2} = \left[\frac{0.8(0.03)(1in)(20.3412\ in^3/s)^2}{(386.22\ in/s^2)(d_1)^5} + \frac{0.8(0.03)(2in)(20.3412\ in^3/s)^2}{(386.22\ in/s^2)(2d_1)^5}\right] \left(0.000598 \frac{lb}{in^3}\right)_{air}$

$d_1 = 0.10109\ in \quad \& \quad d_2 = 2(0.10109) = 0.20218in$

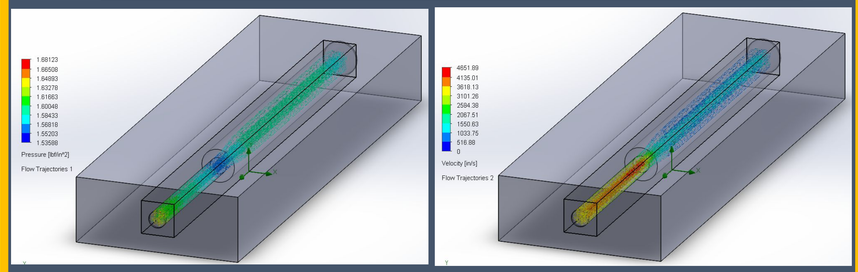

Figure 1. Air flow simulation of Resistive

Performance is measured by ensuring consistent airflow, testing for durability, and gathering user feedback on comfort and usability. The device will also be evaluated for its adaptability to different breathing patterns .

Final Components:

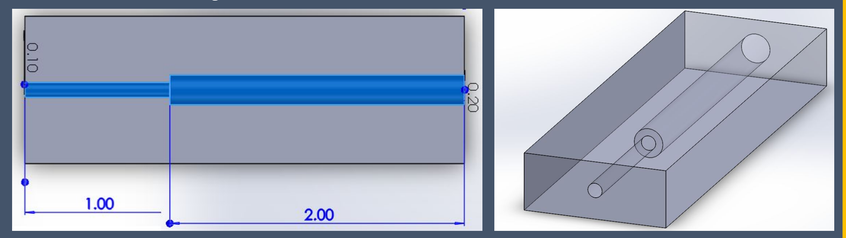

Figure 2. Resistive component

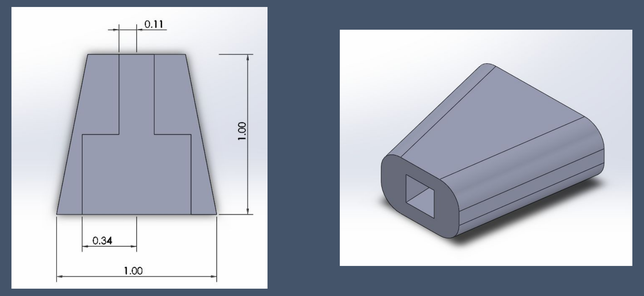

Figure 3. Mouthpiece component

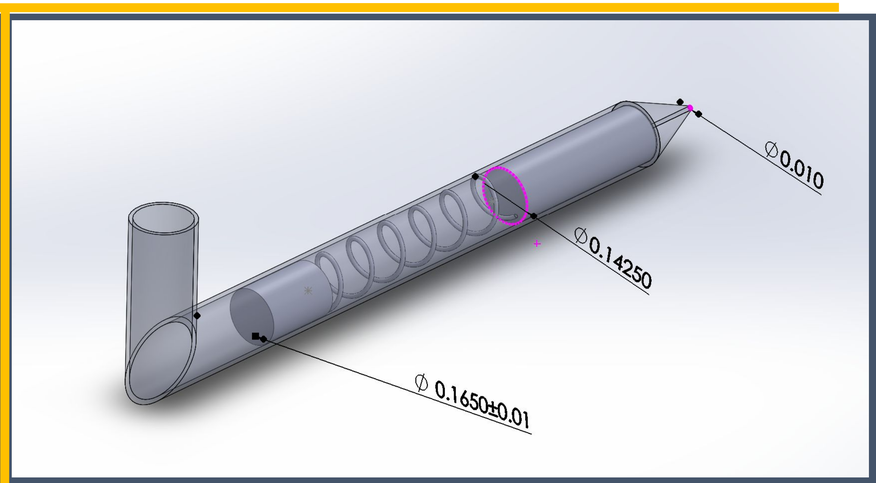

Figure 4. Feedback component

Future Improvements:

- Regulate flow rate
- Add multiple springs
- Add extra resistance
- Change tube length
- Create additional inlets for stronger airflow

Impact:

The proposed breathing device provides an affordable and reliable solution for individuals needing controlled airflow. By promoting regular use, the device helps improve overall breathing efficiency.

References:

[1] Sessions, LunchBox. “Balanced, Pilot Operated Relief Valve.” YouTube, YouTube, 12 June 2016.

[2]Munson, Young, and Okiishi's Fundamentals of Fluid Mechanics, 9th Edition,Gerhart, Hochstein, and Gerhart

[3]Wikipedia Contributors. (n.d.). Venturi effect. Wikipedia, The Free Encyclopedia. 24 February 2025 from https://en.wikipedia.org/wiki/Venturi_effect