Washkewicz College of Engineering

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External O-Ring Assembly Tool

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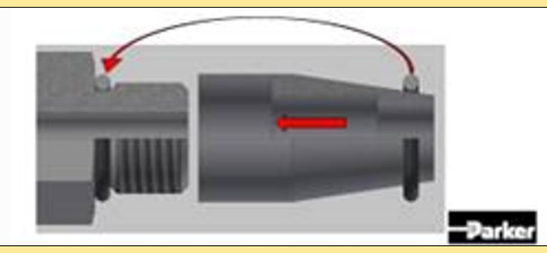
Abstract: The goal of this project was to create a device that can install an O-ring over machined threads without tearing it. The current process caused fatigue on the operators' hands. Through design and calculations, a prototype that is scalable and modular was chosen. It is 3D printable and made with widely available electronics.

Introduction:

- Create an external O-ring application device
- Automatic
- Minimize worker fatigue
- Required working prototype
- Prevent damage to O-rings



Specs:

- Maintain or reduce current cycle time
- 0.5in to 2in O-ring (1in used in prototype)
- Modular and Ergonomic
- Increase diameter by 25%

Theory:

$$F_O = Ay\frac{\Delta L}{L} \qquad \sigma = \frac{F}{A}$$

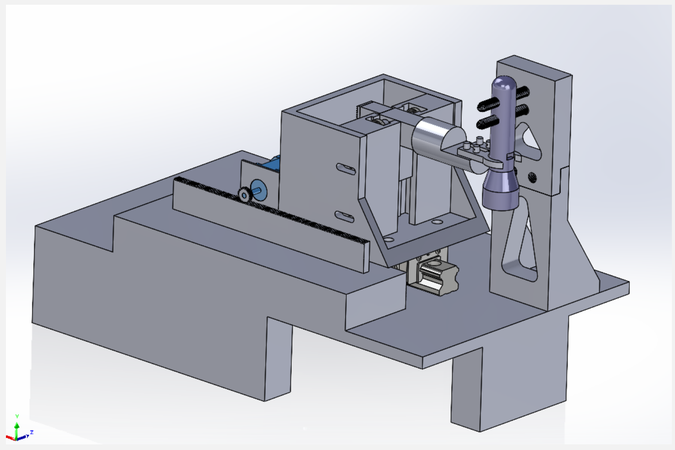
$$F_{rack} = \frac{T_p}{r_p} \qquad \sigma = \frac{Mc}{I}$$

$$Velocity = \frac{d_p * \pi * RPM}{60}$$

Design:

Claw

- Linear X and Y motion with rack and pinion
- Tension springs hold claw arms
- L-Rack guided by ball bearings

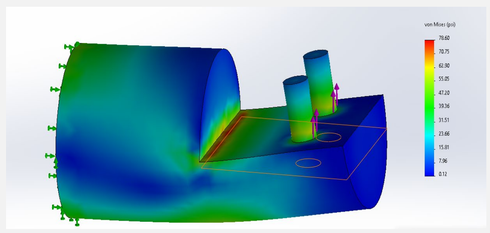


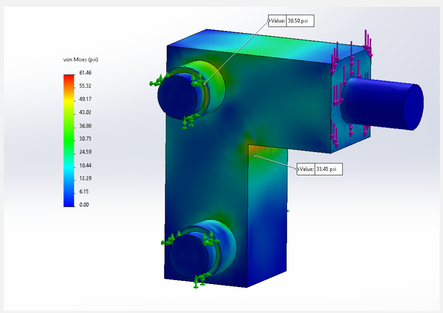
Mandrel

- Tapered end to expand O-ring over threads
- Releases one O-ring at a time

F.E.A

- 3lbs. of force
- PLA has 7000psi tensile strength





Electronics

- Arduino board with GNC controller board (Uses G-Code)
- 12V power with battery supply

Manufacturing:

3-D Printing

- Filament was cheap
- Easy adjustments of CAD or STL files
- Access to multiple printers

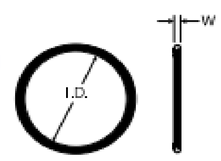
McMaster-Carr

- Specific parts needed
- Carriage (What the vessel is mounted on)
- Rail (Track that carriage moves upon)

SAE O-Ring

SAE Straight Thread Port O-Ring

Specify size and compound
Example: 3-906 NBR (standard NBR)



TUBE FITTING PART #	FITTING DASH SIZE	I.D. (in.)	W (in.)	Material		
				NBR*	FKM**	CNG***
3-902	2	0.24	0.06	•	•	
3-903	3	0.30	0.06	•	•	
3-904	4	0.35	0.07	•	•	•
3-905	5	0.41	0.07	•	•	
3-906	6	0.47	0.08	•	•	•
3-908	8	0.64	0.09	•	•	•
3-910	10	0.76	0.10	•	•	
3-912	12	0.92	0.12	•	•	
3-914	14	1.05	0.12	•	•	
3-916	16	1.17	0.12	•	•	
3-920	20	1.48	0.12	•	•	
3-924	24	1.72	0.12	•	•	
3-932	32	2.34	0.12	•	•	

Conclusion: Developed a prototype designed to install an O-ring over machined metal threads. Final design is modular and scalable with easy to manufacture components. It meets the guidelines set by the sponsor. For future iterations, the claw arms can be modified, the electronic components can be streamlined to aid in user safety, and there will be AC-DC power used in the factory.