Team 10700A Fellowship of the Rings

Make it Real CAD Engineering Challenge

The reason we built this piston was because we found that the main way of getting powered linear motion is using linear slide, which can only output very small amounts of torque, is very unstable, and can break very easily. We came up with a 3D printed piston that is powered by a vex motor has lots of torque, can extend to around 1.8 times its original size, and is very sturdy.

Our CADed motorized piston will improve stability and power/ motor requirement of lifts used in VEX IQ challenges. The new part can be used instead of rack-and-pinion systems to power lifts like elevator lifts or by itself (see Fig 1). It can lift end-effectors to score on heights above the starting height limit. It can also output large amounts of torque in a linear motion.

The way the piston works it by having a worm gear in the casing for the base of the piston (see Fig 2) which then meshes with a linear rack gear which is on the shaft of the piston (see Fig 3) there is a 2 by 4 beam on the bottom of the piston where you can attach a vex motor which powers the work gears (see Fig

4). By using a linear rack gear and work gear combination we get a very large amount of torque, but as a result the piston is quite slow. Even though it still more powerful, sturdier, and faster than using linear slide with a high torque gear ratio.

From this challenge, we have learned how to CAD pieces to mesh with existing VEX IQ pieces and to convert those mesh renderings to a regular object. This experience will be valuable in the future to 3D-print pieces for VEX RC. This element can be used to expand by height, to outtake. If rings need to be scored on any posts, a motorized piston will be used with the lift. If two sets of end effectors are used on one lift, one would be mounted on the back of the lift. If there were two end effectors and a four reverse four bar, the motorized piston could help it function. If the backplate of the lift is too short to outtake, the motorized piston would help the end effector move up, to score. The first iteration will be used for testing purposes. We will be testing if the motorized pistol will be able to carry an end effector.

We used Tinkercad to CAD the piston. Though to put the vex pieces into tinkercad, we had to first convert them to usable files to a tinkercad compatible form, but even then we were encountering mesh merge errors that would sometimes cause the

program to crash. But once we learned how to convert from mesh we had virtually no problems.

Figure 1: piston being used in a robot

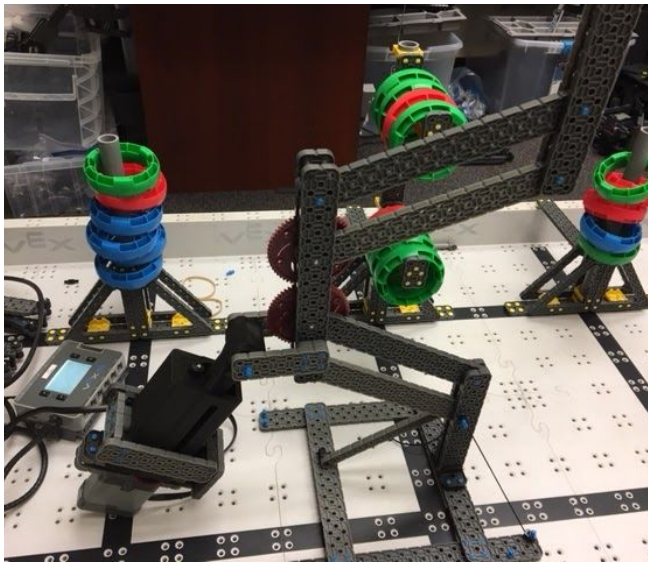

Figure 2: worm gear in the piston

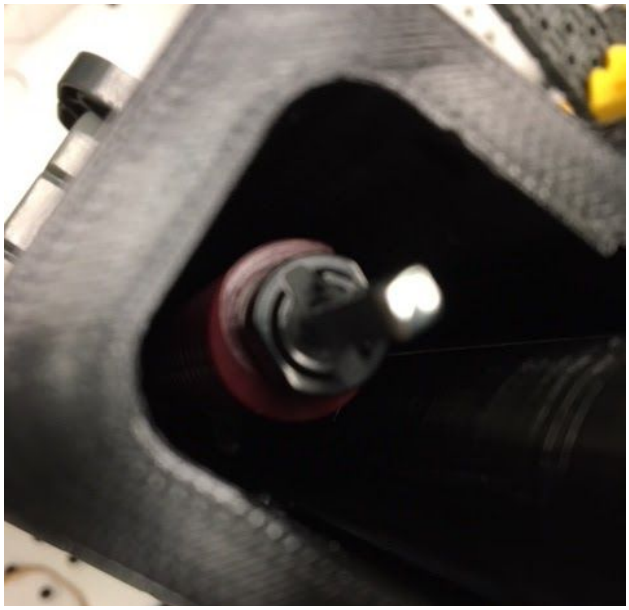

Figure 3: linear rack and shaft of piston

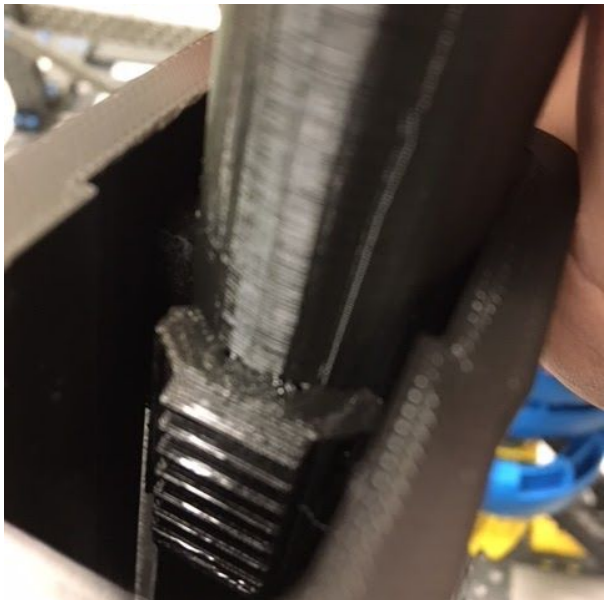

Figure 4: vex motor powering the piston

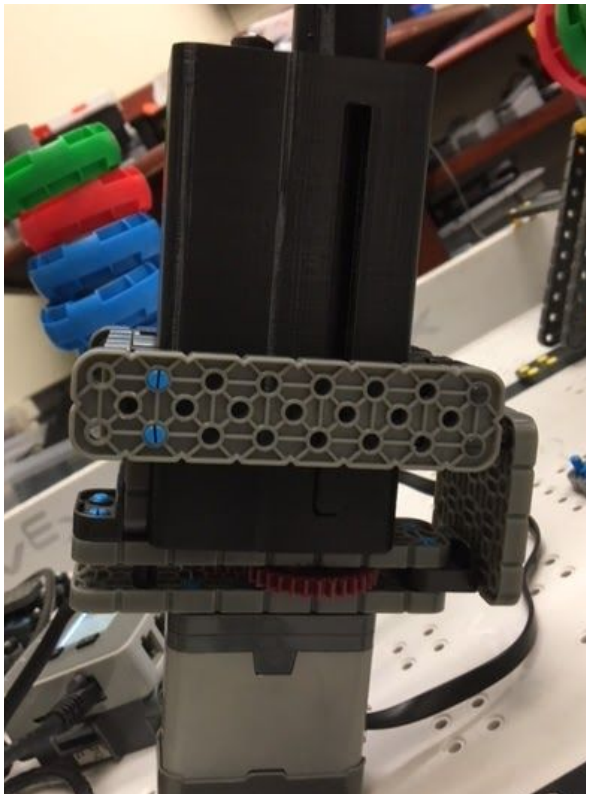

Figure 5: testing the force output by the piston

Figure 6: testing the pistons ability to lift a 4 to 4 bar to the top pole

Figure 7: printing the piston

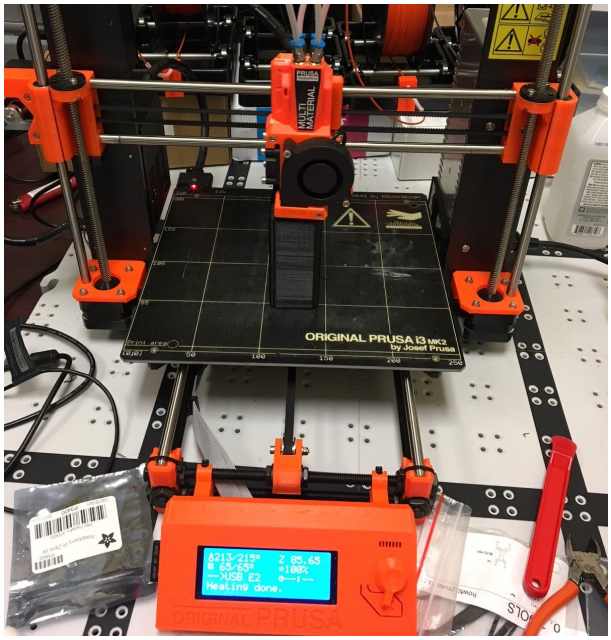

Figure 8: printing the piston