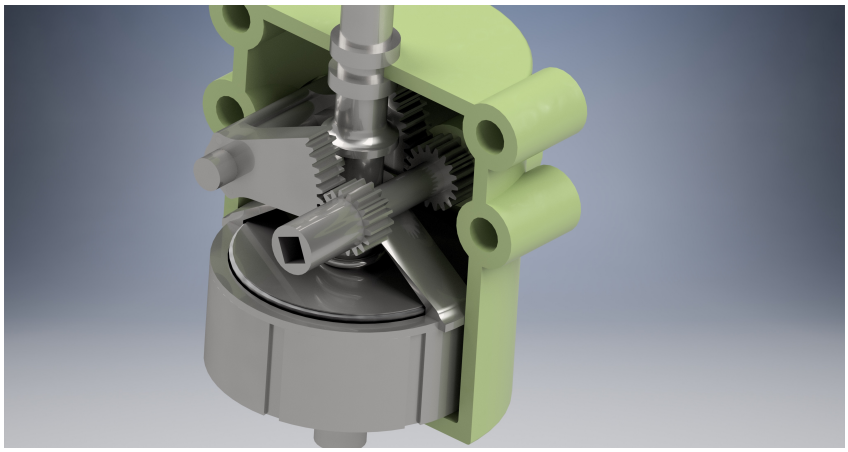
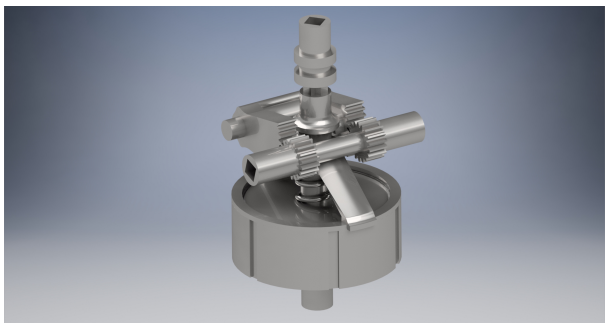
Clutching at Straws

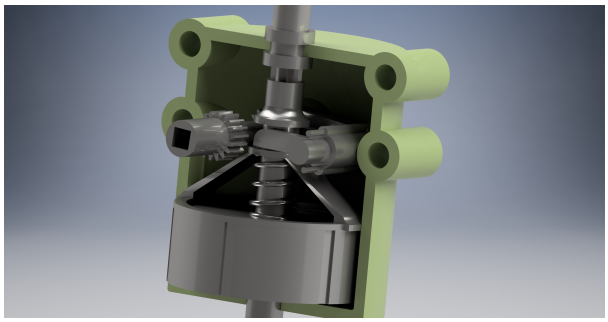


Many people that we speak to at competitions wish there was a proper working VEX EDR Clutch; so I designed it. I have designed a new VEX EDR Clutch due to the significant inefficiencies of the original part. The original design meant that it was difficult to engage and disengage power transmission from your motors to your contraptions. The clutch I have designed takes reference from a cone clutch design – images detailing this will be included later in the document.

This clutch unit would be used in a drive train. One side (the input) will be your motion from your motors and the other side (the output) will go to any contraption you want to power. With this design, a motor, servo or other would be able to rotate one of the two shafts to engage or disengage the clutch. When the clutch is engaged, the motion from your motors can come in on one side and go out the other side. However, when the clutch is disengaged the motion from the motors is not able to transfer through the clutch to the output, enabling the output side to spin freely.

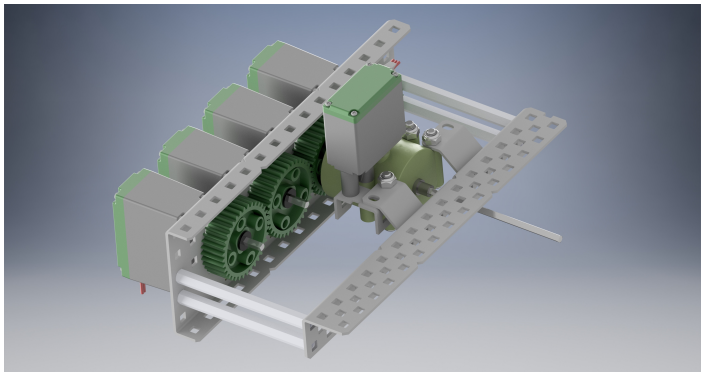


Assembly internals - engaged



Assembly internals with casing - engaged

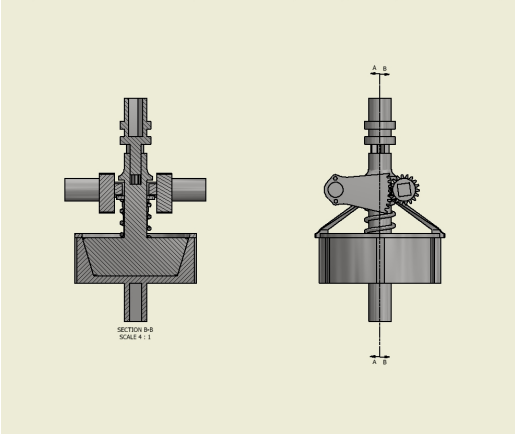
My clutch could be used in many ways, both as part of prototype for testing and part of a complete robot design. One example for either use would be a gearbox, allowing you to disengage the gears from your motor, meaning you can use one motor selectively for multiple jobs. This could enable you to swap your gear ratios to change the purpose of the motor quickly, freeing up the number of motors you can use. Another example could be a catapult trigger mechanism so you can disengage the motors to enable the string drum to spin freely without the motors slowing it down.



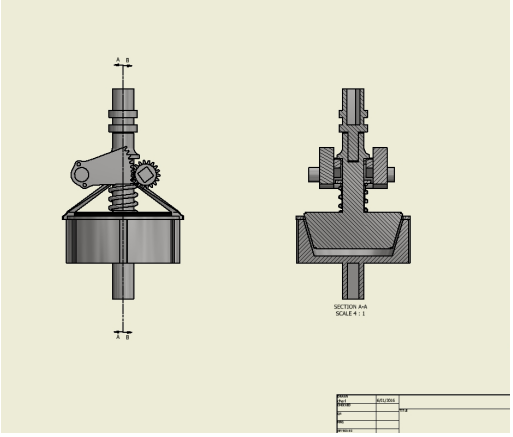
Example of clutch in a drive chain to engage and disengage the motors.
It would be possible to place a gearbox on the other side of this

To design this part I used Autodesk Inventor Professional 2016, and I used a wide variety of features and techniques. These feautres include:

- Measuring Tool. This helped to measure the pre-existing VEX parts to ensure compatibility with the part I was designing
- Coil Tool. This was used to create the spring and then using Driven Constraints to contract and expand the spring
- Mirror Command. This command (with Remove Original enabled) was used to create the second side of the outer casing
- Rectangle Pattern Tool. This was used to copy identical features to different places on the part (e.g. the screw holes on the outer casing)



Section view of engaged clutch



Section view of disengaged clutch

The main difficulty I had with this project was not the clutch itself, but rather the trigger mechanism. I overcame this issue by researching real clutch designs and using them a guide to create a simple and compact trigger mechanism. The issues that I faced with this problem caused me to consider multiple designs before I reached my final product.

I learned many things in the process of designing this part, from a design, engineering, and competition perspective. I expanded my existing knowledge of CAD with things like how Driven Dimensions are used, and improved my general efficiency with using Autodesk inventor. I discovered the details of the inner workings of a clutch, and that having the ability to use one motor for multiple tasks is useful in competition due to the motor number restrcitions. Autodesk Inventor helps my schools Robotics team by helping us save time, as we always design our robot on Autodesk Inventor first before we build it. This means we build it once and we build it right. I will continue to use Autodesk Inventor in the future because it is something I really enjoy working with and on, and one day I hope to have a career as a Design Engineer.