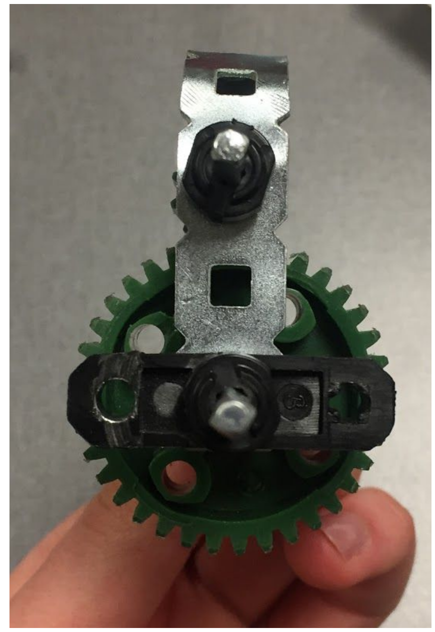
Shaft Load Bearing

by Team 2567A

Introduction:



When fabricating, teams have discovered Saint-Venant's, Abbe's, and the Exact Constraint Design principles themselves: that a shaft must be balanced and supported from both ends in order for the design to succeed. Often, however, VEX competition students are forced to use whole clunky lengths of c-channel aligned with each other on either end of the shaft which add weight and take up space in the design. In order to similarly prevent the three loading cases on a shaft: axial, torsion, and bending, we created a single part which functions as a second point of support for the shaft.

This will greatly reduce the material used in constructing chassis and even finer subsystems like the intakes. It will make teams more flexible in designing their robots by their preferences.

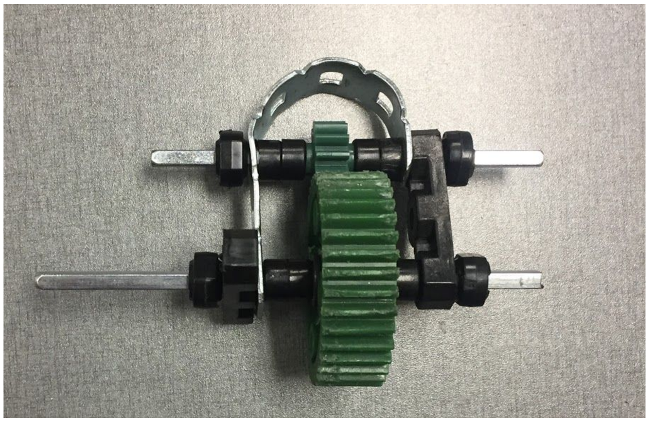
Explanation:

One side of the shaft load bearing can be attached to C-Channel or any other component with standard VEX spacing. In between the center bearing hole of the part attached to the robot and the bottom bearing hole on the opposite side, users should carefully use correct black or white spacers, washers, or a combination of other pieces to position their gears or sprockets on the shaft so that it does not misalign the shaft.

Any combination of gears or sprockets (high strength or regular) up to 1.25" in height span from shaft to the bottom of the ceiling of the shaft load bearing may be used with clearance. This allows teams to have a minimalistic "gearbox" that is easily supported on the side of their chassis and can even take the load of small wheels without bending or twisting.

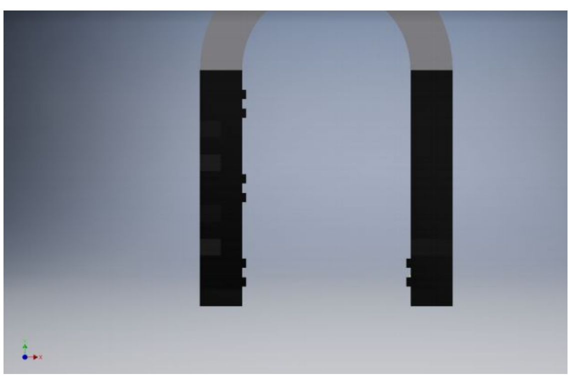
The possibilities for this new component are endless. We are looking to improve it by adding standard VEX spacing on the top so that it can partially house bevel gears like a 90 degree gearbox. With more spacings, teams will be able to add more components like standoffs or single bands to the top and across to reinforce the component. Making it expandable and customizable with clasps, would further allow teams to lengthen or widen the piece so that more power transmission components can be supported with less material.

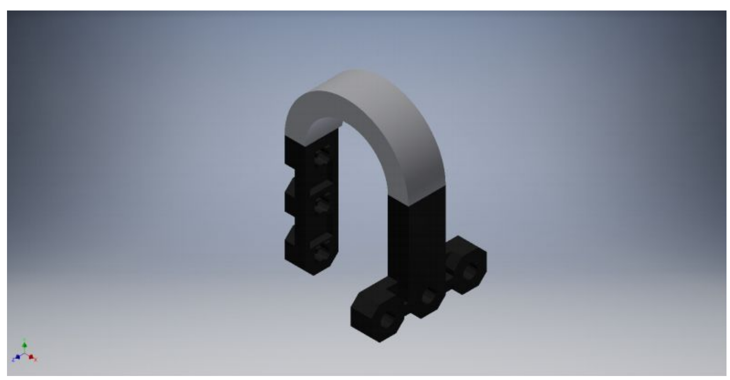
How it was Created:
Software used: Autodesk Inventor 2018 Student



The new part is largely an extension between two perpendicular bearings facing each other.
Initially, we prototyped it out of single steel band (1.75”) and two black bearings.

In Inventor, the center of the bearing facing the inside of the gears lying parallel to the ground was extruded so that it first formed a T-shape of the same material. Then, a bearing was placed perpendicular to the ground, and a half circle (1.5” diameter outer and 1.25” diameter inner) connected the two pieces. We chose a circle for its structural strength and ability to prevent (side to side) warping from one bearing to the other.



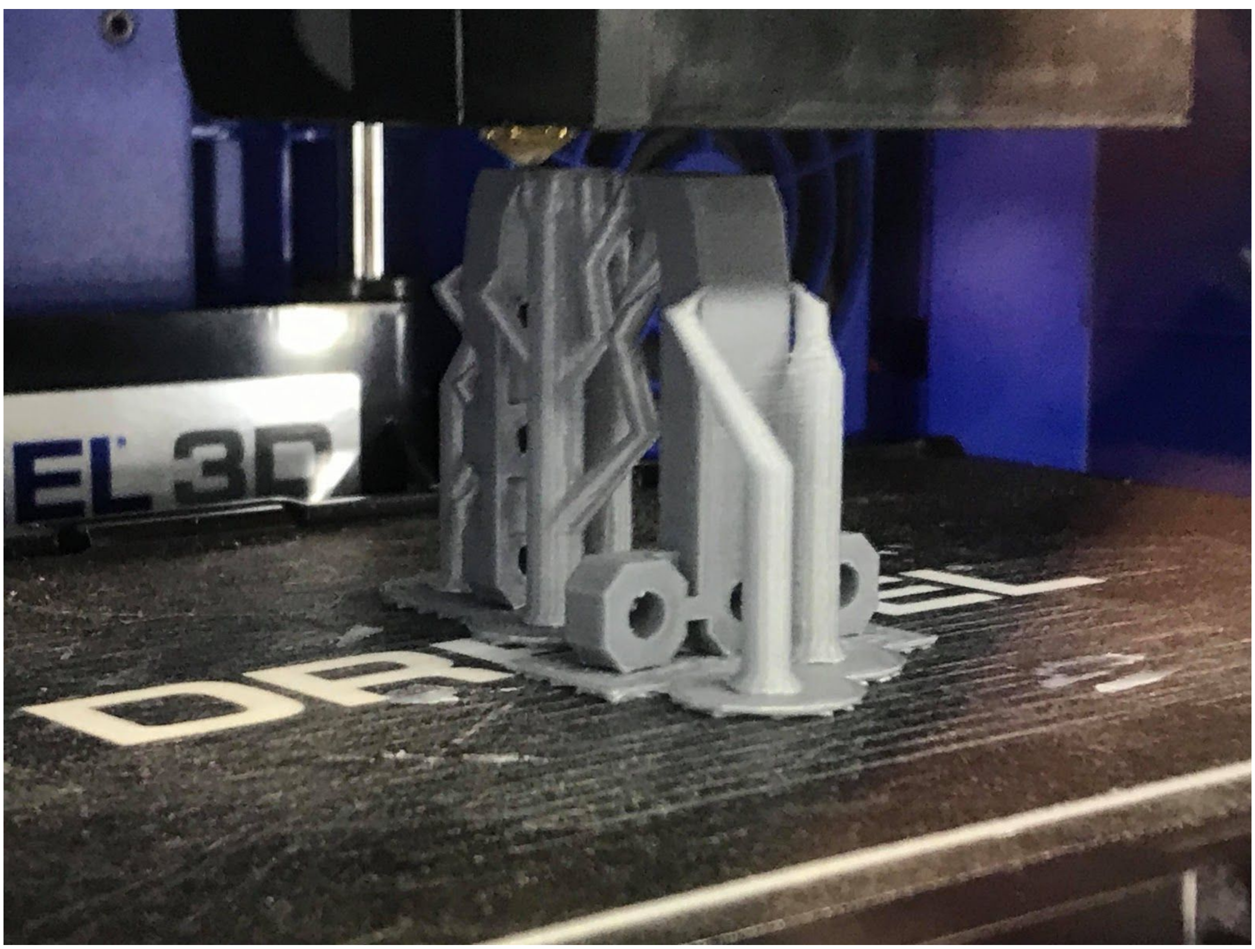


Conclusion:

Using Inventor is always eye-opening to the little details in our materials. We also realized that, after prototyping this innovation with simple steel bands and bearings, we could likewise shape future creations and bend the material to our will. We had to consider constraints, such as the desirable height of the piece so that more combinations of gears, sprockets, and wheels could be used without risking the structural stability of the piece. We likewise had to decide between the shapes and the orientation of the piece, but we soon found out the the piece was applicable in more than just the way we intended it to be: either bearing could be attached to a wall, and the piece could lay horizontal or vertical depending on the fitments demanded in the design.

We normally rely on 3D software to a) model initial ideas of the robot without using material and b) to have interactive documentation of the designs after they have been fabricated, modified, and even disassembled. This year, we heavily relied on CAD models of excellent launchers from the Nothing But Net season and expansions from Skyrise to innovate upon. Not only is 3D modeling software a good way to immortalize our creations, but it provides us with guides for future designs and helps us develop detail-oriented eyes.

Next, we hope to explore the force analysis and simulation possibilities of Inventor to make better structural decisions when it comes to building the robot. Inventor and 3D modeling skills are translatable past robotics, past the Physics classroom, past the Project Lead the Way curriculum, as we see it applied in the inception of the most complicated articulated arms in factories to the smallest electronic components.



Pictured above is the Shaft Load-Bearing in the 3D printer.