One Way Passive Lock

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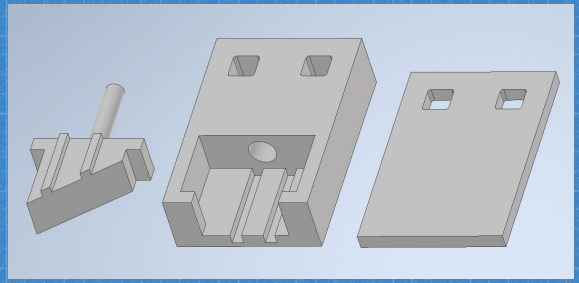
1

How it works

How it works

With the passive lock, an object is able to slide pass the lock in one direction, but not the other. This is because in one direction, the object is able to lift up the angled piece to allow for the object to move. However, once the object passes, the angled piece is forced back down by the spring. When the object is moved in the reverse direction, the flat side of the angled piece does not allow for it to lift, therefore stopping movement.

The part is designed with two holes at the top allowing it to be mounted to metal pieces using two standard VEX screws. The part is 1 inch wide, 0.5 inch thick and 1.5 inches tall, allowing it to be conveniently added to a standard VEX 1.5 inch C-channel.



The components used in the lock (spring not shown)

An animation of the part in motion, which can also be seen here

2

How it has evolved

#1 Initial Design

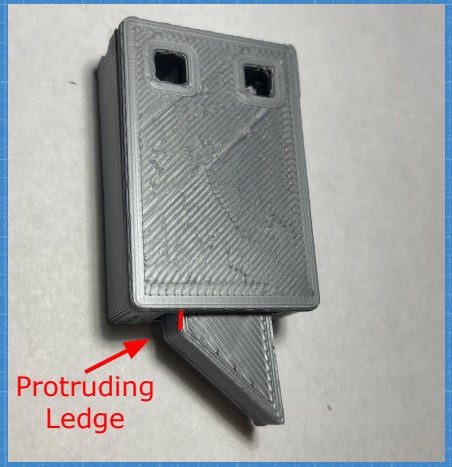
The Idea

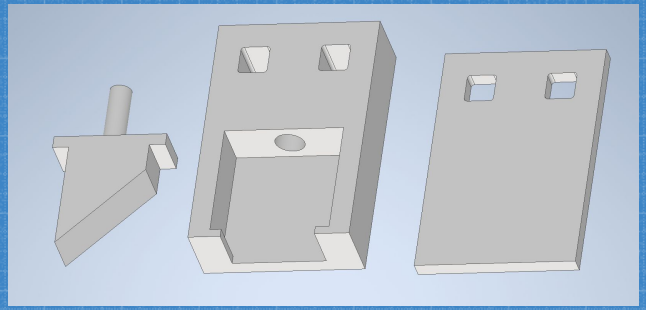
The angled piece of the passive lock, was designed with a 45 degree incline to allow an object to pass in one direction, but be blocked in the reverse direction.

The Animation

Downsides

The animation, also seen here, shows the multiple faults with the original design. As the object moves, it first hits the protruding ledge, making it more difficult to pass. As the object tries to move in the reverse direction, the angled piece is allowed to rotate, without securely blocking the object. This is due to the excessively large tolerances and the lack of a way to prevent the rotation.





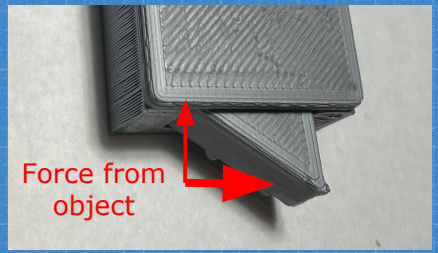
#2 Improved Design

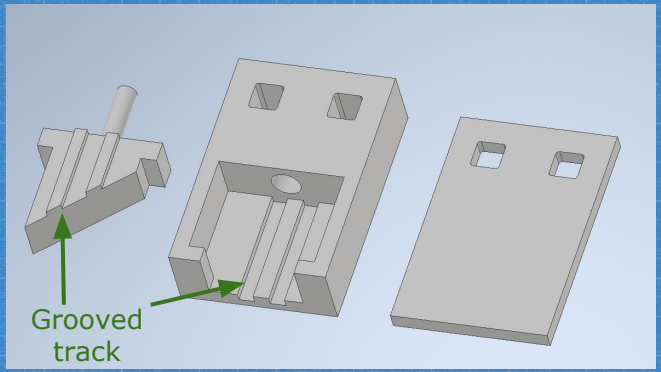
The Idea

Taking the issues of the initial design into account, the second design eliminated the protruding ledge of the angled piece. In addition, to prevent rotation, corresponding grooves and rails were added to the main piece and angled piece, respectively. The tolerances were also improved to further limit rotation.

Downsides

The 45 degree incline on the angled piece makes it difficult to slide into the main piece when the object passes.





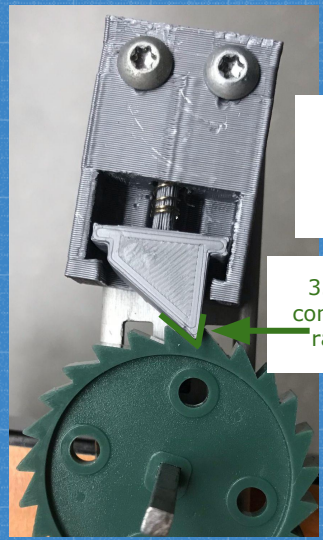
#3 Final Design

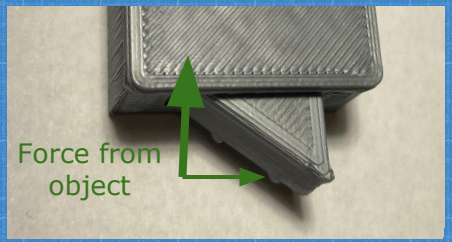
The Idea

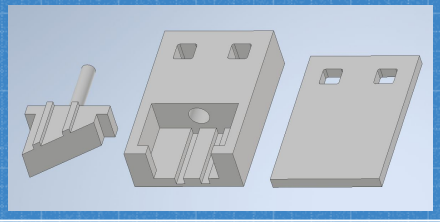
The incline of the angled piece was reduced from 45 to 35 degrees, making it easier to slide into the main piece when the object passes. In addition, the 35 degree angle allows the passive lock to be compatible with a VEX ratchet gear.

Future changes

In the future, the size could be adjusted to fit different VEX components, such as two or five hole C-channel. the material to be more sturdy would also be beneficial by increasing its durability.







3

How it can be used

How the part can be used in VEX robotics

2021-2022 Change Up

I was inspired to create this part after our team faced difficulty when trying to hold onto mobile goals. This passive lock does not require any motor or power as it clamps onto the inside of the goal, allowing for more freedom in motor placement. In addition to defending the goal from the opposing alliance, it also allows the goals to be held in place while scoring rings.

Historically

This part would have been especially useful for the 2017-2018 game, Tower Takeover, because it also used mobile goals that the lock could latch onto. In addition, this part could have been used on the 2015-2016 game, Nothing but Net, where many designs included a large ramp that had to expand by sliding and locking in place.

Uses for 2021-2022 Change Up

To test the effectiveness of the part, our team printed it out of PLA plastic and attached it to a chassis.

The above video, also seen here, shows the robot driving into the mobile goal before driving back with the goal secured.

The above video, also seen here, shows a side view of the mobile goal secured after the angled piece dropped down.

What I learned

I learned many things while working on this project, especially since this was my first time using Autodesk Inventor Professional 2022. Although it is similar to other three-dimensional designing programs I have used before, I still had to reference multiple video tutorials. I started by making a two-dimensional sketch, which I used to refine my original idea. After extruding the design, I was able to see if any changes needed to be made before printing it. After printing the parts, I was able to revise the sketch.

I also learned how to create an Autodesk Inventor, animation presentation. After exploring the software and watching videos, I was able to move and rotate the virtual components to model how the lock works. Learning how to use this software was very important since it allowed me to display something that is difficult to video record. This is also beneficial, since I am now able to better express my ideas and designs.

Learning how to use three-dimensional CAD (Computer-aided design) software will be very important for my future. I plan to pursue engineering, where jobs may require or prioritize applicants that have experience in three-dimensional designing. This type of interactive design can also help communicate designs much better than words.

How I created this

To create the three-dimensional models I used:
Autodesk Inventor Professional 2022

To create the three-dimensional animations I used:
Autodesk Inventor Professional 2022

To three-dimensionally print the designs I used:
Original Prusa i3 MK3S+ 3D Printer

To create the slides presentation I used:
Google Slides

The presentation template was found on SlidesCarnival