

Design Project 3 – 3D Printed Artifact Cryptex

My 3D puzzle is inspired by the “Cryptex” as shown in the Da Vinci Code (Image 1). It is unclear where and when it was invented, but it is a simple device comprised of an inner and outer hollow cylinder. The inner cylinder goes into the outer one and is held in place by several rings with characters on them. Only when the characters are aligned to the correct password will the rings be configured in a way that allows free movement of the inner cylinder out of the outer cylinder. The inner cylinder could store something precious, like a message or a small precious object. Only someone with the correct code can open the Cryptex and see what is inside. If you force it open, you risk breaking the delicate object inside!

To design this, I looked at a few inspirations online. The one shown below was particularly helpful. Imagine a square superimposed on the outer cylinder (Image 2, 3). At two adjacent corners of the square are teeth and at the other two corners are gaps, for the teeth of the inner cylinder (Image 4) to fit in. Once the inner cylinder is in clearly it cannot move around, since its teeth hit against the solid wall of the outer cylinder. The inner rings (Image 5) also have gaps. These gaps are wider than the teeth of either cylinder. However there are only two gaps on each inner ring. The inner rings have a very interesting design that deliberately makes them hard to remove – so that once the Cryptex is assembled it holds strong. To slide the inner rings onto the outer cylinder you have to slip gaps over the teeth and slide each ring in. Then once the rings are in place they can swivel around freely because the inner section of the ring is wide enough to not be obstructed by the outer cylinder’s teeth. To slide the inner cylinder in place one must move the rings’ gaps in line with the outer cylinder’s gaps so that the inner cylinder’s teeth are not obstructed on the way in. Once it is in, if one swivels the rings around, one cannot move the inner cylinder out, because the teeth of the inner cylinder cannot move out of the rings unless the rings are perfectly aligned. The outer rings (Image 6) serve two purposes, hiding the inner rings and allowing a user to set a password for the system.



Image 1: Cryptex shown in Dan Brown's "The Da Vinci Code"

Ishaan Jhaveri

INFO 4320: Introduction to Rapid Prototyping

Instructor: Francois Gumbetierre

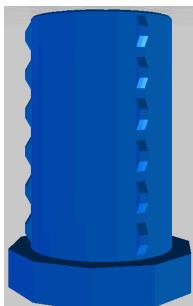


Image 2: Outer Cylinder Teeth View

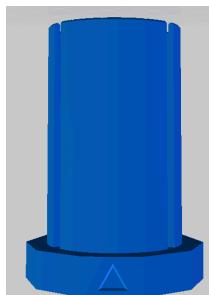


Image 3: Outer Cylinder Gap View

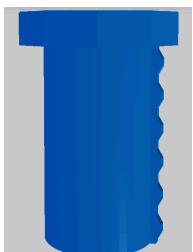


Image 4: Inner Cylinder



Image 5: Inner Ring



Image 6: Inner Ring

My design was based on this system. It differed slightly in how I designed my teeth. I CAD'd up completely from scratch and came up with my own measurements.

To help with scaling I printed a mini version of the Cryptex (Image 7) with inner and outer rings attached with a hardcoded password of 9999.



Image 7: mini Cryptex

The main trouble I had when I printed my design out is that when I made the gaps between the inner and outer ring too small on the CAD, they printed together, and when I made them too large, the outer ring fit too loosely around the inner ring. I corrected this by printing them too large and then adding a layer of cardboard in the inner ring so the outer ring fits more snugly around it. I also made a small calculation error which resulted in my rings being about $1/16^{\text{th}}$ of an inch too short. The scale of the mini Cryptex meant I

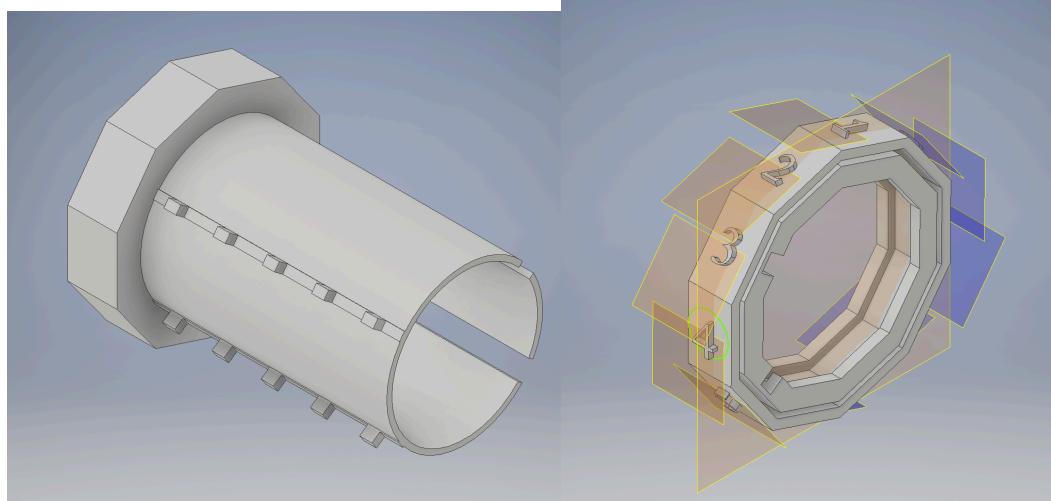
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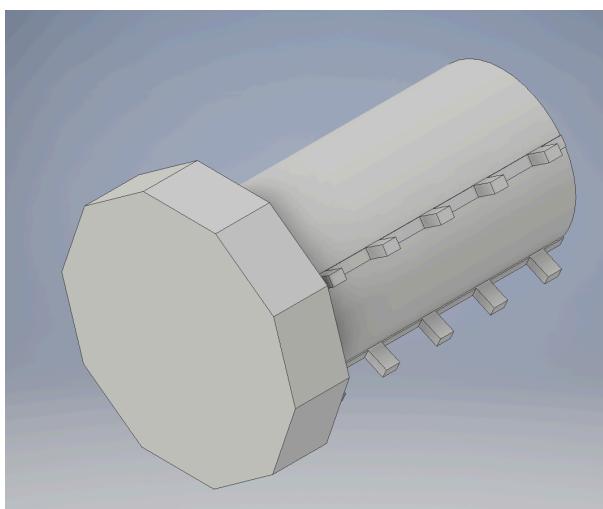
didn't run into this problem at that size. I corrected this problem also by adding a layer of cardboard to each ring to make each a little taller. If 3d printing time permits before Friday I am going to reprint all the rings to correct both these issues. If not I will film the videos with the cardboard patch-ups, and then reprint the Cryptex properly next week.

Below I have shown images of all the parts of my design. I also attached the ipt and iam files with this submission.



Outer Cylinder

Ring



Inner Cylinder



Actual Cryptex