Final Changes for Drum and Design Choices for Drum

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Link to this SSA

`https://www.overleaf.com/read/hkbmgmkjpppq#927add`

Goals

- To hollow out the drum and make necessary supports for the shaft
- To explain as many design choices for the drum as possible using a short summary

Summary

The drum was redesigned on NX since it was initially made in onshape by Sem. After that the drum was hollowed and supports were made for the shaft that ran through the drum.

1 Elaboration

1.1 Re-creating in NX

The first step was to recreate the shape of the drum in NX. All necessary dimensions were known and the sketch used to obtain the shape is displayed below 1.

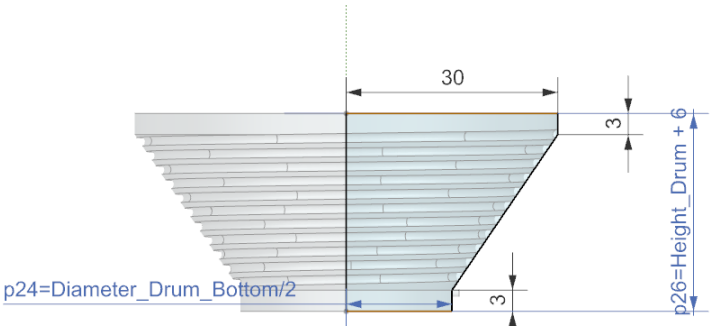

Figure 1: Initial Sketch

Here the bottom diameter is 30mm (ie; radius 15mm) and top diameter is 60mm (iel radius 30mm). The height of the drum is 28mm in total.

Next, the hole for the shaft needed to be sketched. The sketch 2 required for the hole in the shaft was already accessible to me since it was used while designing a previous drum. Hence, it was reused and extruded 3 here.

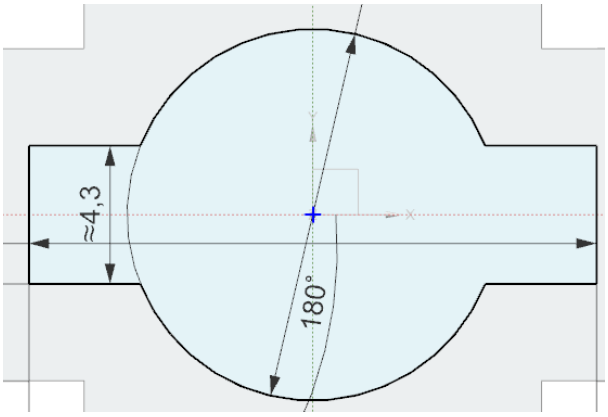

Figure 2: Sketch for Axle Hole

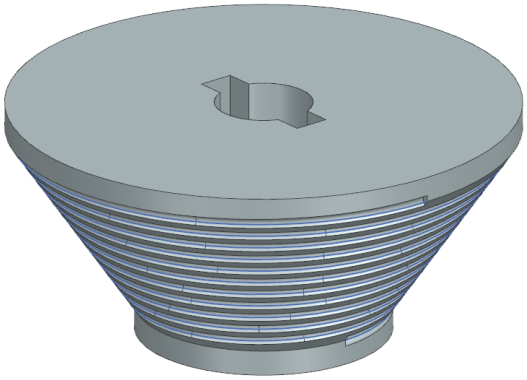

Figure 3: Enter Caption

Once the drum geometry was ready, the shell operation was used to hollow out the drum so that the walls were 3mm thick. The resultant drum is displayed below 4.

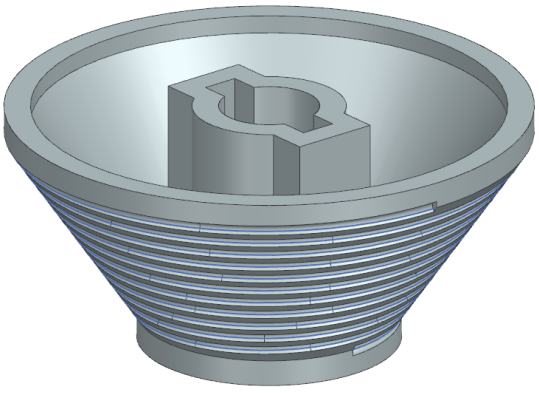

Figure 4: Hollowed Drum

The shaft was detached from the drum upon using the shell function, hence it was reattached using four supports on the top and bottom as shown below inf figures 5 and 6.

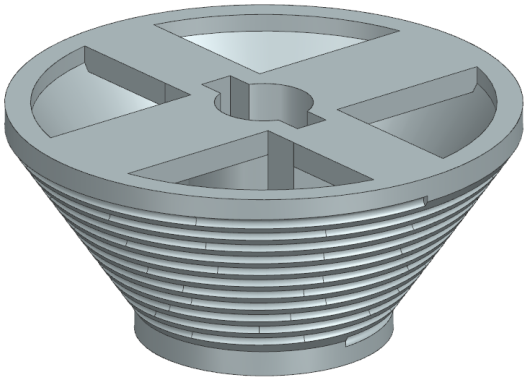

Figure 5: Top View of Drum

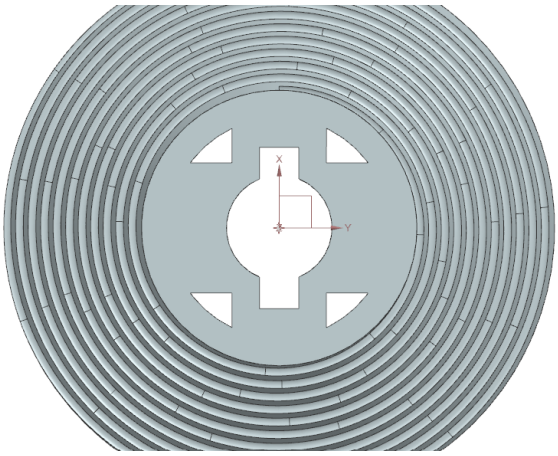

Figure 6: Bottom View of Drum

Finally, the drum requires a small pin at the bottom so that winding it becomes convenient and easy. For this, a datum plane was made tangent to the surface and a small cylinder was extruded 7.

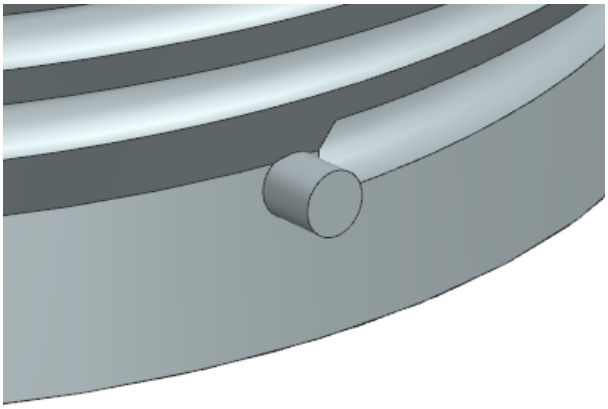

Figure 7: Addition of Pin

1.2 Design Choices for The Drum

Initially, when theorizing the drum, a design as shown in fig 8 was coined. It was hypothesized that it would be ideal to slowly increase the velocity of the rotating arm and then keep the plane at maximum velocity till the end of the motion. However, after testing drum 8, it was understood that the rotating arm slowed down significantly once the string started unwinding around the cylindrical part of the drum. After analyzing this testing data, a new drum were with a shape of a truncated cone as shown in fig 9 (with a diameter of 30mm at the top and 15mm at the bottom) was formulated. This drum was tested and nevertheless resulted in deceleration of the rotating arm after a certain point.

It was also noted that the grooves of drum 9 were not deep enough to wind the drum easily, which proved to be another design flaw.

Upon detailed analysis, breakdown and research, it was understood that the lack of torque provided by the drum (As shown in graph 10) caused the issues pertaining to undesirable deceleration. To solve it, a similar shaped drum (as drum 9) with larger diameters(60mm at the top and 30mm at the bottom) and deeper grooves (To make it easier to wind the drum) was tested.

The testing results proved that increasing the torque provided by the drum, indeed solved the unwanted decelerations. Simultaneously, the newly designed deeper grooves on the drum helped wind the drum easily.

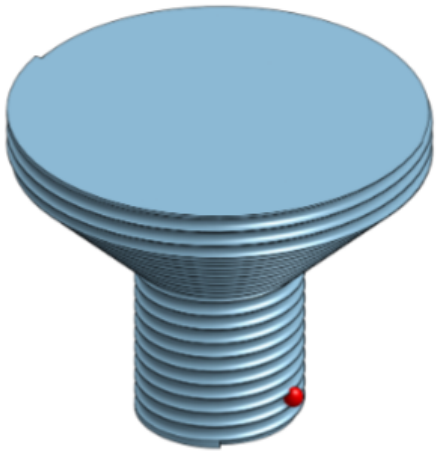

Figure 8: First Drum Concept

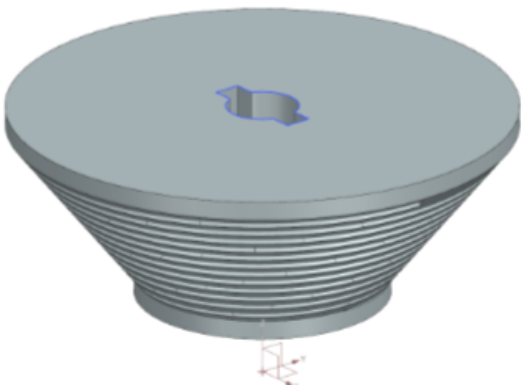

Figure 9: Second Drum COncept

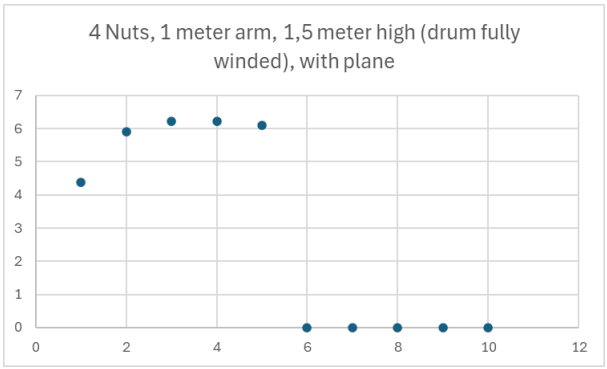

Figure 10: Graph for Drum 1

1.3 Recommendations and Future Use

Since the section for design choices is small, it is recommended that the smaller design choices for the drum (such as the attachment of the string to the drum) are elaborated in the appendix. It is also recommended that other drum designs that were not tested (or rejected), be displayed and/or elaborated in the appendix, if there isn't enough space in the design choices section.

Finally, it is also recommended that more visualized data (graphs made by Ruben for example) from the testing, be used here to reason the design choices with numbers. This would then clearly portray that all the decisions made by the group were based on either physical concepts/theory or real-life data. Hence, giving the report more credibility.

Unfortunately, not all the visualized data could be added here in this SSA, hence it is recommended that the graphs be made properly and in the same format, so that it is more intuitive for a reader.