

Final Product Testing Proof

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Summary:

The purpose of the project is to create a kinetic sculpture that contains several engineering concepts that illustrates moving parts which. The sculpture consist of two main sections, one is the bird model that includes moving wings and a tail. The second section is a box that contains the mechanism. The project is designated to start by an interacting user. The user will start the sculpture's movement by rotating a crank handle that rotates the crankshaft which transfers the energy to the remaining mechanical parts such as; gears, rods and a pulley system. The artistic part of this project will be illustrated through the bird movement of wings and tail with the assistant of mechanical engineering concepts. The project also utilizes methods of artistic creative skills by using engineering equipment along with different materials that completes the sculpture. The testing of the subsystems would be acquired by attaining the parts needed. We have tested each part separately. Testing procedures were conducted on the following subsystems;

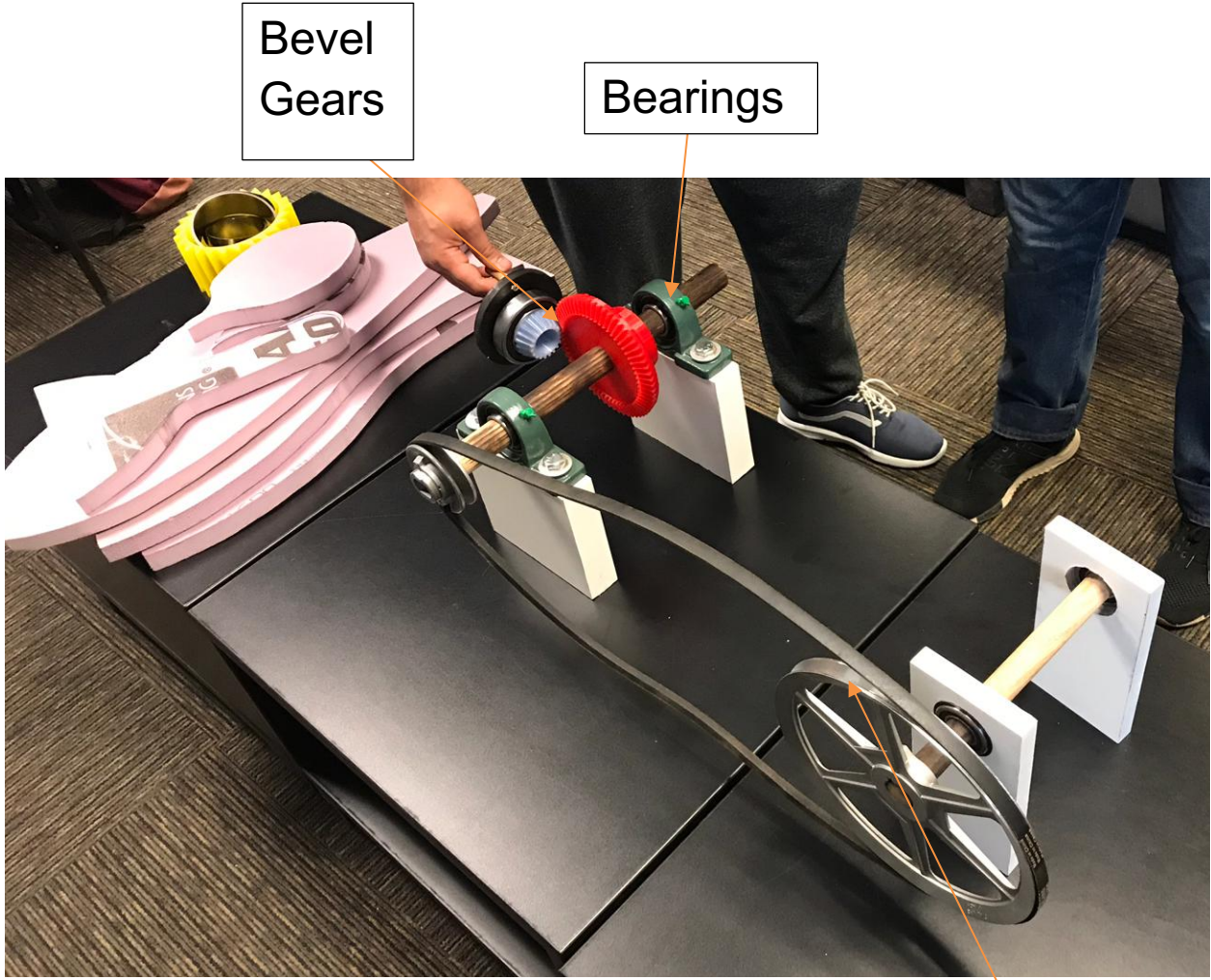


Figure 1: Subsystems

V-Belt (Pulley System)

Crankshaft:

Procedures:

The crankshaft is an essential part for starting the movement to activate the mechanisms for the entire device. It will be worked by human physical power into a counter clockwise rotation by a circular force getting to move the entire shaft to get the movement going. The shaft movement would rotate with the smallest amount of energy loss and least amount of friction due to the bearings attached causing a smooth rotational movement.

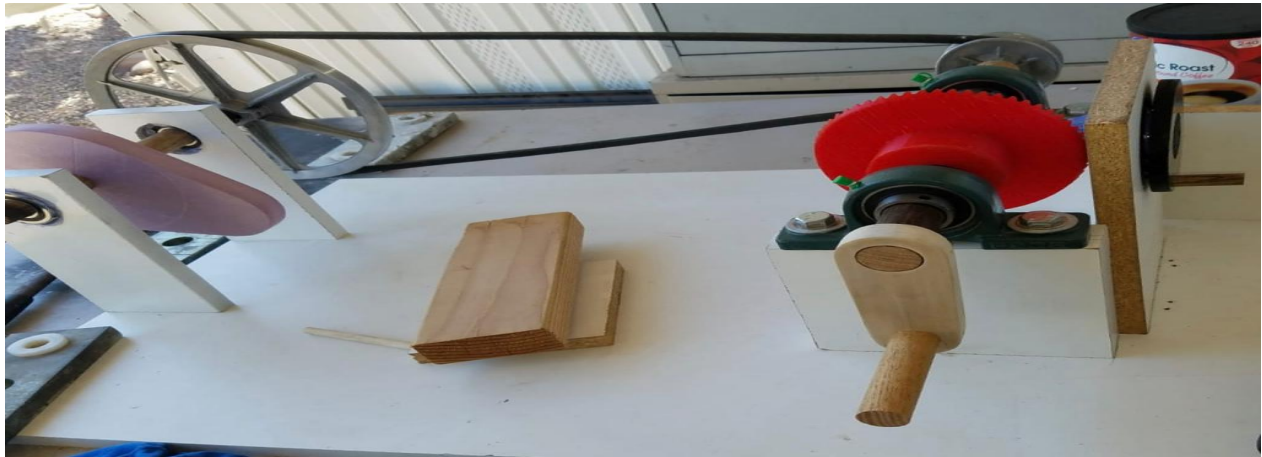


Figure 2: Crankshaft

Testing:

Table 1: Crankshaft

Crankshaft	Crank Handle	Shaft
1st Test	Handle wasn't stable and shaking.	Rotation was rigid and movement was hard
2nd Test	Handle was a little edgy and sharp	Crankshaft started to move, but still rigid and hard to move.
3rd Test	Success rate reached 100% succession	Item started working 100% properly

Bevel Gears:

Procedures:

After getting movement from the shaft, the bevel gear starts rotating on a clockwise direction transferring energy from front view to the side view of the device due to 90 degree positioning. As the Big gear starts to drive the smaller gear, rotation starts in an instant. The opposite end of the smaller gear has an eccentric pulley connected to it. Therefore, energy is transferred to a PEX plastic pipes that are attached to a pulley thus starting a vertical movement to make the wings execute an adequate motion.

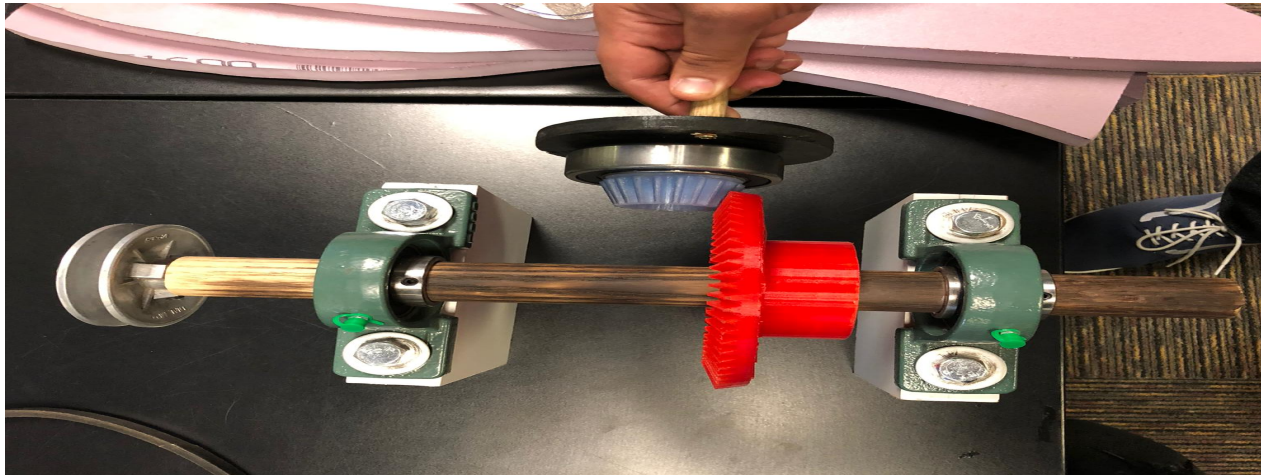


Figure 3: Gears

Testing:

Table 2: Bevel Gears Test

Gears:	Big Bevel Gear	Small Bevel Gear	Eccentric pulleys attached
1st Test	Gear worked as required. The gear is dense and durable.	The gear gave excellent results and is also durable.	Faced an issue with being stiff.
2nd Test	Kept giving good results.	90 degree attachment sustained position and worked properly.	Started pulling off and working well.
3rd Test	Item sustained a 100% activity and durability test	Item also sustained 100% achievement and durability.	Started working perfectly without any issues.

V-Belt:

Procedures:

From the same main source of energy the shaft causes the small timing pulley to move on a clockwise rotation. Within the small timing pulley a rubber belt is attached from the end of the shaft where the small timing pulley is located towards the other side into the big timing pulley where it has another smaller wooden shaft attached. As the shaft starts rotating the V-Belt starts making its movement and technique towards transferring the energy into the smaller wooden shaft and an eccentric wheel attached close to the center where a piece of wood starts pushing the tail to start moving in a vertical realistic movement.

Testing:

Table 3: V-Belt Test

V-belt	Big Timing Pulley	Small Timing Pulley	Belt
1st Test	The pulley was working well. However, little vibration were detected.	The small Pulley had a minor shake and lack of stability	V-Belt was a little loose and refused to be attached
2nd Test	After adjusting the pulley's position the movement started to work better.	Fixed, but the movement was rigid and slow	Movement started although stability needed to be fixed
3rd Test	Pulley is working well. No issues were detected.	Worked well. No issues were found	V-Belt attached properly giving the right movement maintaining stability and correct action



Figure 4: V-Belt Back View



Figure 5: V-Belt Side View

Bearing :

Procedures:

As the shaft starts moving the bearings has an efficient role into reducing the friction and loss of energy. The first two bearings are attached into the wooden base that are wider than it is in height which is carrying the main shaft. The amount of mechanisms located on the main shaft requires sturdy and strong bearings. The two other bearings (Bearing #3 & 4) are located on a secondary shaft with a smaller diameter. Smaller bearings are used due to the lower energy needed to start the tail movement. Furthermore, the last two bearings dimensions proved adequate to the amount of energy transferred. Friction was at a minimal level which helped in stabilizing the overall movement.

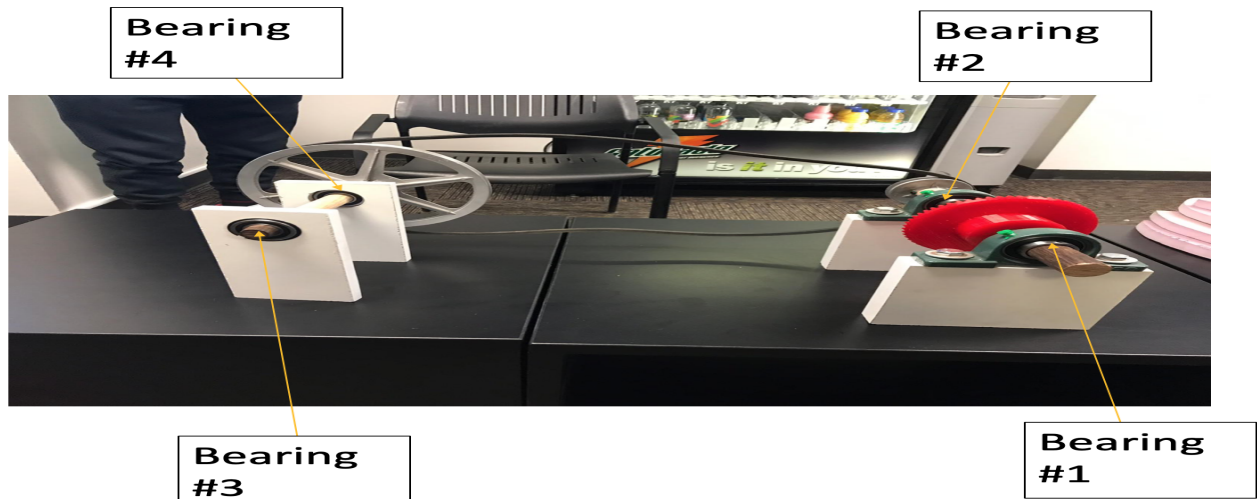


Figure 6: Bearings

Testing:

Table 4: Bearing Test

Bearing	#1	#2	#3	#4
1st Test	Stiff rotation. WD 40 was added as a lubrication.	Same as Bearing #1. WD 40 was added.	Movement was unstable. The Shaft needed sanding.	The bearing had a small shake through fitting it into the wooden hole
2nd Test	Rotates well. No issues were detected.	Positioning needed adjustment.	No Issues were detected.	A minor slip occurred from attaching the wood and had to burn the end tip
3rd Test	No issues.	No issues.	No Issues.	No Issues.