Spring 2017

Evolution and Innerworking of a Car Differential

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Recommended Citation
Weiss, Aaron and Loiselle, Caleb, "Evolution and Innerworking of a Car Differential" (2017). *Thinking Matters Symposium Archive*. 115.
https://digitalcommons.usm.maine.edu/thinking_matters/115

EVOLUTION AND INNERWORKINGS OF A CAR DIFFERENTIAL

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Abstract

- Create interactive demonstration pieces that display basic concepts of a car differential using visual aids as in the educational video 'Around the Corner (1937): How differential Steering Works'.
- Fabricate a custom stand for an open ended car differential. The final design of the car differential will be run by an on/off switch and a motor.
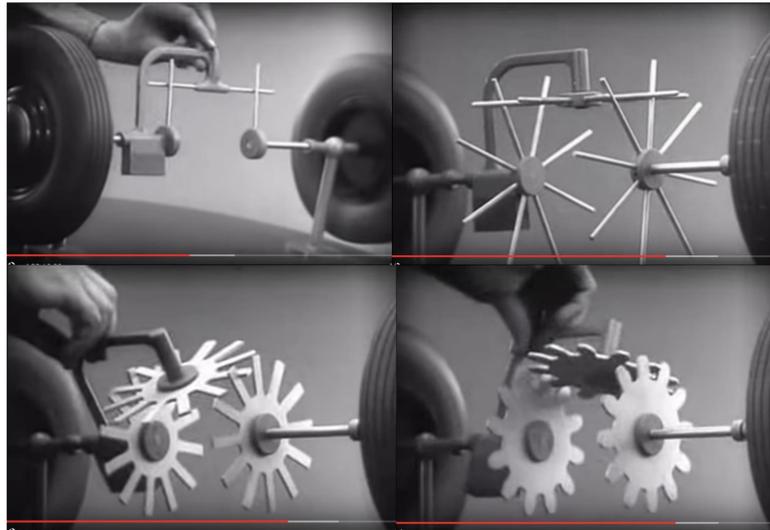
Figure 1. Snap shots from 'Around the Corner (1937) How Differential Steering Works'.

Introduction and Background

A car differential is used to transmit power from the drive shaft to two separate outputs; wheels. A complex gear system allows the active wheels of a car to turn at different velocities. This is the solution to cars not being able to turn if they were to have a solid axel. Our project demonstrate how the differential allows a vehicle to turn without binding its wheels.

Figure 2. car differential before customization

Process and objectives

- Simulate a working differential with brakes and an input power from an electric motor.
- Create different generational steps of gear systems using SolidWorks to demonstrate the purpose and evolution of a car differential.
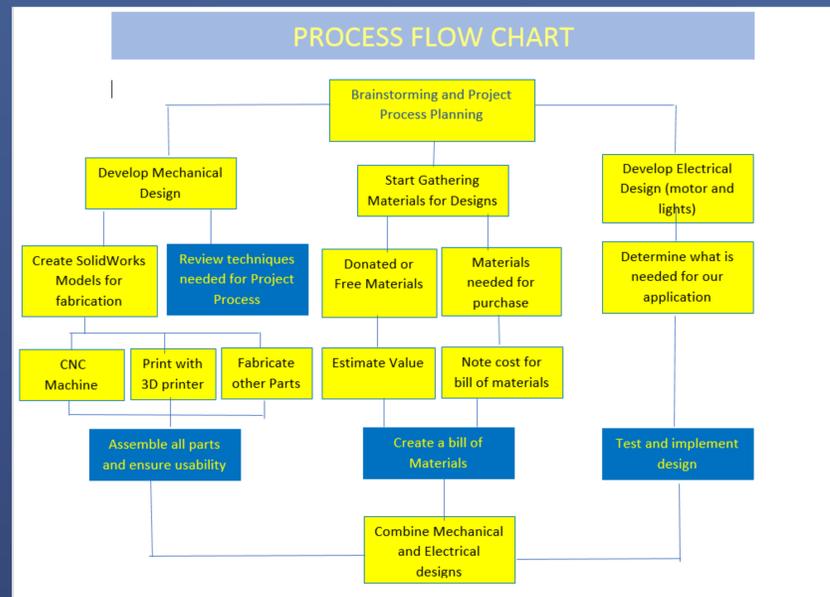

Figure 3. Process Flow Chart of the project development

Hardware/Software Operations

- Hardware:
  - Welding
  - Plasma cutting
  - Right angle grinder
  - Lathe technology
  - 3D printing technology
  - CNC machine
  - Abrasive chop saw
  - Milling
  - Heat forming
- Software:
  - SolidWorks 3D Design
  - SolidWorks Drawings
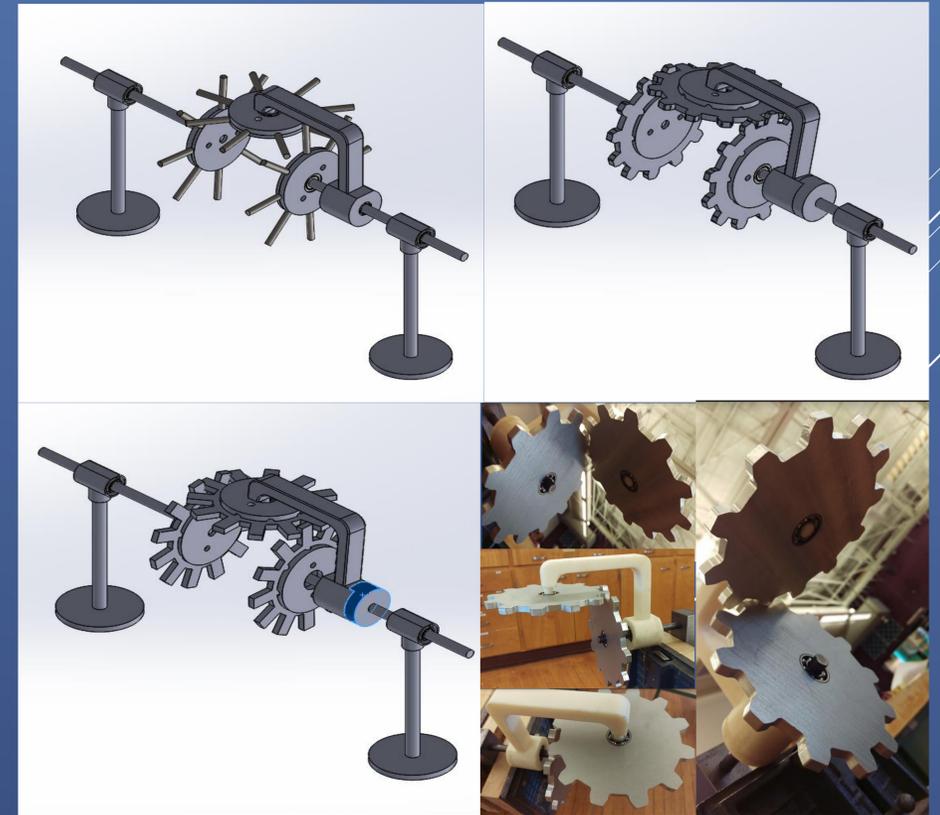 - SolidWorks Motion Analysis

Figure 4. Generational steps of a car differential

Conclusion

There are two final products:
1). A mini differential set that, in a classroom setting, demonstrates how the spider gears can transform one rotational input to two separate variable rotational outputs.
2). Custom-fabricated differential that displays the innerworkings of a vehicle differential in motion using viewing ports.

Figure 5. Custom-fabricated differential display