Virtual Design Review 1

Team 09: Sprag Clutch Addition to Reciprocating Lever Transmission

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Introduction

Why study bicycles and their efficiency?

More efficient bicycles can increase power generation amongst cyclists and decrease stress on rider's joints.

The current project will focus on increasing the efficiency of the bike through the drivetrain.

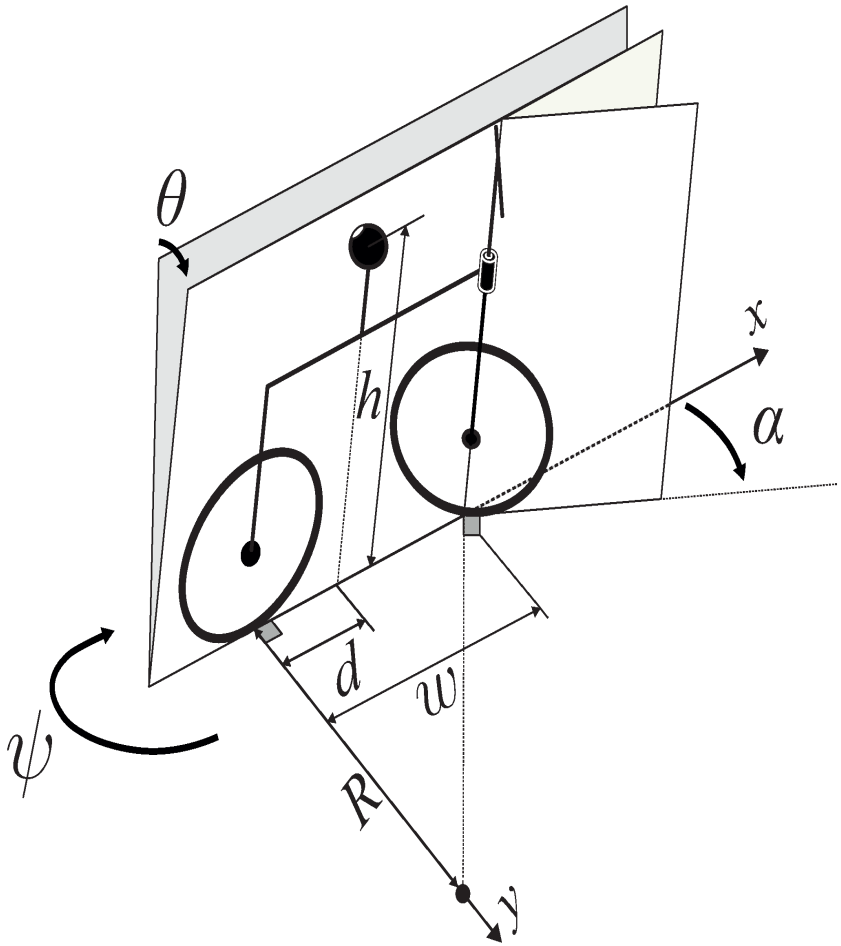

Figure 1: Bicycle force diagram

Meet the Team

Daniel T. Dudley, *Financial Advisor*, Senior, Mechanical Engineering

Samuel E. Grambling, *Administrative Engineer*, Senior, Mechanical Engineering

Iain C. Marsh, *Team Leader,* Senior, Mechanical Engineering

Grant T. Parker, *Design Engineer*, Senior, Mechanical Engineering

Angela N. Trent, *Research Engineer*, Senior, Mechanical Engineering

Project Summary Brief

- The Mechanical Engineering department at the FAMU-FSU College of Engineering has partnered with Gordon Hansen to sponsor team 9.
- Team 9 will work on adding sprag clutches to the original reciprocating lever transmission design that Gordon Hansen has been sponsoring for the past 2 years.

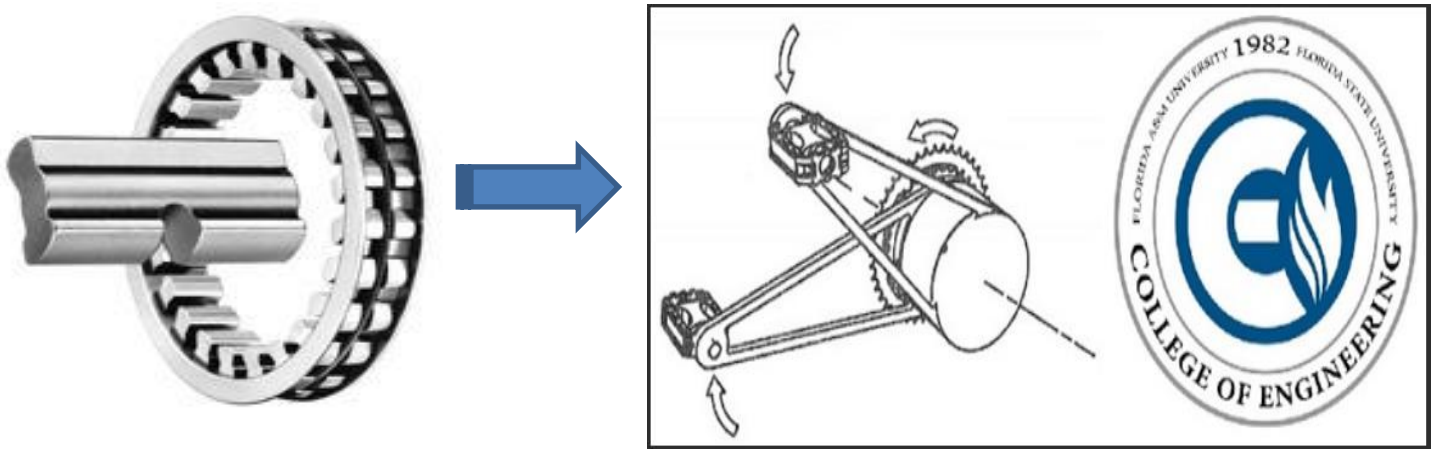

Figure 2: Addition of sprag clutch to RLT

Background

- The RLT motion has one pedal pushed down while the other moves up.
- A sprag clutch consists of an inner and outer race with sprags in between
- Transmits torque from one race to the other.
- The sprags permit rotation in one direction and back stopping in the other.
- Applications:
  - Rear wheel hubs in bicycles
  - Helicopters

Figure 3: Sprag clutch

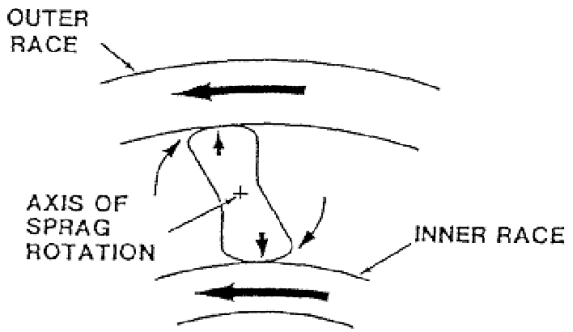

Figure 4: Sprag clutch components

Project Scope

- Project Description
  - To make the addition of sprag clutches to a reciprocating lever transmission, and improvements to improve power outage over a normal bike

- Key Goals
  - Gain a power advantage over normal bike
  - With gain in power reduce strain on joints
  - Ensure the bike rolls backwards
  - Greener Alternative to other transportation method

- Market
  - Primary: Anyone looking for an easier means of transportation over normal bike
  - Secondary: Bike Collectors, Exercise Equipment, Human Powered Vehicles

Project Scope (cont.)

- Assumptions
  - Normal bike frame will work for this style of bike
  - No complications arise from addition of sprag clutches
  - Or in obtaining sprag clutches
  - The new pedaling motion will not be difficult to learn

- Stakeholders
  - Gordon Hansen (Sponsor)
  - Dr. Shayne McConomy (Instructor)
  - Group Members

Customer Needs

- Gordon was issued United States Patent US8763481 on July 1, 2014, for a Reciprocating Lever Transmission utilizing one-way sprag clutches.
- Gordon believes the one-way ratchet and pawl mechanisms used by the previous teams are less reliable than one-way sprag clutches.
- Gordon anticipates that utilizing 14” long reciprocating crank arms and sprag clutches will result in a power increase and reduce knee and hip stresses when compared to conventional 7” long crank arms.

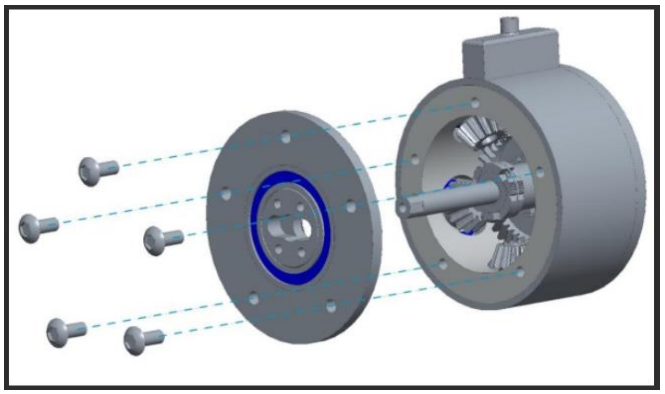

Figure 5: Current RLT design with rachet and pawl

Figure 6: Crank arm length

Functional Decomposition

- Allow the bicycle to ride freely when power applied to pedals has stopped
- Transmit power from pedals to the output shaft using sprag clutches
- Return non-driven pedal to peak position
- Adjust neutral zone for rider comfortability
- Limit pedal travel from contacting the ground

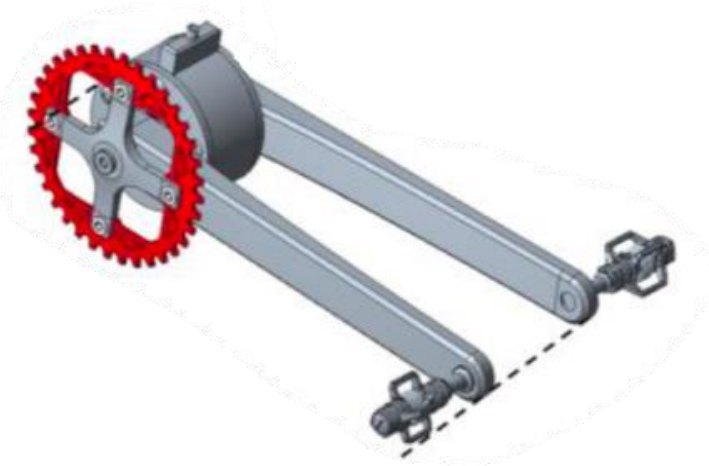

Figure 7: Pedal neutral position

Questions?

Backup Slides

Reciprocating Lever Transmission

Current Design