Design and Assembly of a Spring-Powered Engine Starter Prototype

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Objective & Motivation
Automotive engines require substantial amounts of energy to start, and this energy is commonly provided by lead-acid batteries. This project investigates the possibility of utilizing a mechanical spring to store the energy instead of a hazardous battery. A proof of concept prototype has been constructed that uses a manually wound spring to start a motorcycle.

Spring Selection
Spring was selected based on calculations that took into consideration how much torque was required to overcome friction (2.56 N-m), pressure buildup (8.84 N-m), and expel gases (3.36 N-m), as well as bring the engine up to 300 rpm in about 1.5 revolutions. Specific dimensions were determined by optimizing spring diameter, length, and number of coils to find those dimensions that would result in the smallest possible spring mass, while still having an endurance strength of 830 MPa and a spring index (coil diameter/wire diameter) of at least 5.

Future Work
Preliminary results indicate that the current spring chosen may be too stiff. This is likely because spring was designed to bring the shaft up to speed in 1.5 revolutions, but is not kept at that speed. Before testing the prototype on an engine, future work on this project would include selecting a new, less stiff spring that will produce at least 2 revolutions at speeds equal to or greater than 300 rpm.

Results
Upon initial test runs the following concerns became apparent:
- Spring releases energy too quickly, producing a near impact loading
- Concern exists that the shafts are not able to withstand this suddenly applied load