

Abstract

Paper shredders protect privacy by destroying confidential material. Unfortunately, the paper shredders of today are noisy, unreliable, and expensive. Our sponsor, Mr. Seth Lewis, is the president of the Manhattan Group; a company in a multi-million dollar business distributing paper shredders under the “Royal” brand name around the world.

To improve upon his paper shredder, Mr. Seth Lewis requested three areas of research. The first is to develop a way to measure torque required to shred paper. The second is to design the most efficient gear train; optimizing the number of gears while reducing motor size. The third is to reduce noise output by 10 decibels using acoustic dampening materials.

The class divided into three teams based on personal areas of interest.

The torque team developed a method to measure voltage and current input into the paper shredder in order to determine torque needed to shred variable sheets of paper. This procedure had a 99% correlation with a method using strain gages which measured torque directly.

The Gear team contacted numerous gear manufacturing companies and gear types. Double helical gears were discovered to be the most efficient and quiet gear. Since torque measures were needed by the gear team before any gear design could be prototyped, the gear team spent more time helping the torque team.

The sound team first measured noise generated by the paper shredder and compared it with noise generated after encasing the gear train with sound dampening material. Noise was reduced by a few decibels. With careful analysis of the paper shredder, it was determined that the main source of the noise is generated by the first gear.

The development of the torque measurement method gives a simple way to determine torque required to shred paper in all devices; giving manufacturers a chance to optimize the gear trains other than guess and check. Since sound dampening material minimally reduced noise, future work should be focused on the first gear and how noise is generated. With the combined research, the Manhattan Group has an edge on the competition with potentially more reliable and less noisy paper shredders for a lower price.