

Mechanical Shredder

Project Proposal

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Dec 2, 2014

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Overview

- Customer Needs and Requirements Review
- QFD and HOQ assessment
- Decision Matrix Criteria and Concept Designs
- Chosen Design Product and Mechanism Overview
- SolidWorks of Retrofit System
- Bill of materials

Customer Needs Review and Project Goal

- The Customer needs a paper shredder that is completely mechanical, portable, environmentally friendly, and can compete with an electric paper shredder
- The group will be limited to a budget of \$100 for our designs and the system has to fit within a 5ft³ volume
- Paper shredder must shred 10 sheets per feed, 36 pages/minute, and shred paper, CD's and Credit Cards

Additional Requirements

- Find an electric paper shredder to purchase and retrofit for project
- Shredder must have option to be wall-mounted, or stand on its own.
- Handle preferably on front face of shredder.

Constraints

- Environmentally friendly with minimum carbon footprint.
- The design cost must be less than \$100.00 for fabrication.
- Minimum of 10 sheets per feed.
- Speed: 36 pages/min.
- Paper size: 8.5x11 inches.
- Type of material shredded: Papers, CDs, Credit cards.
- Volume: 5ft³

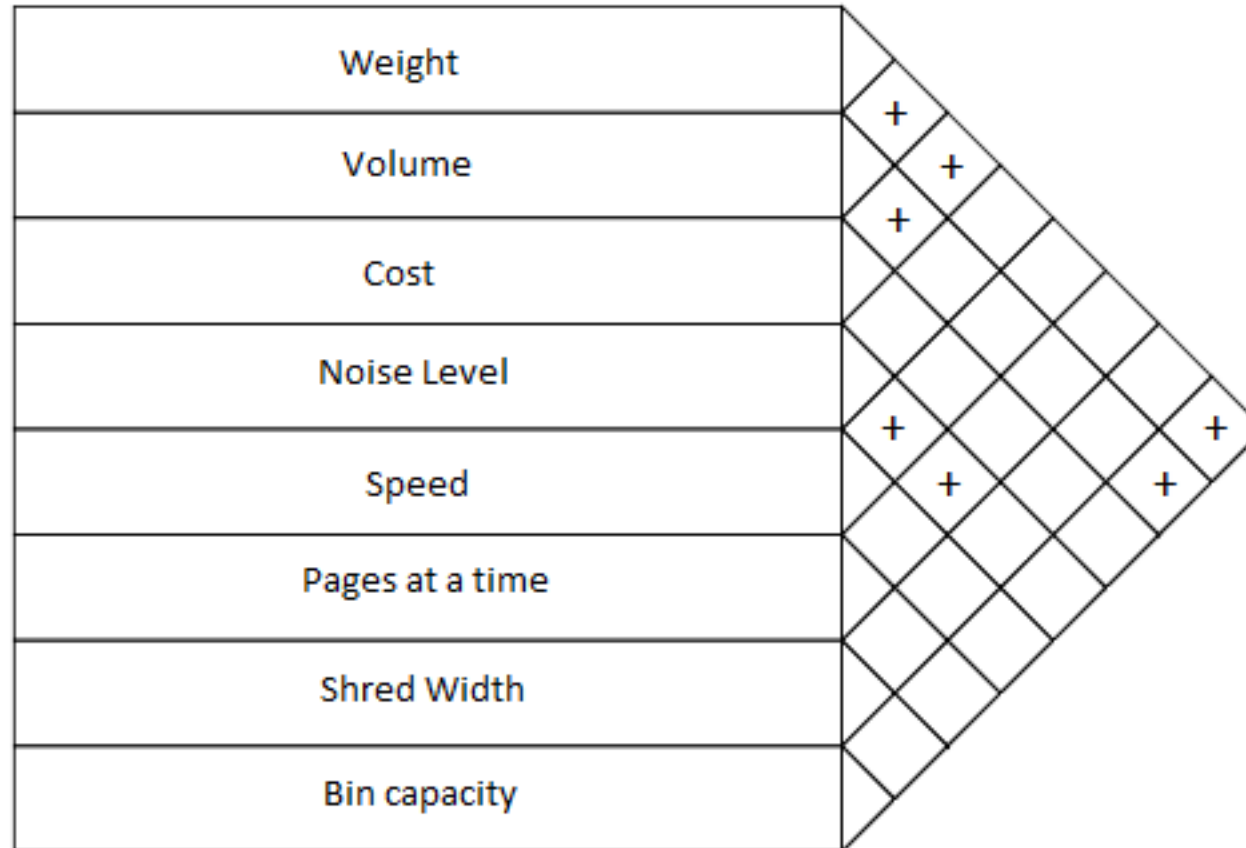
Testing Environment

- An office that can at least fit a 5ft³ mechanical system, and wall space that system can be attached to
- Data to collect and analyze:
 - Run time
 - Shred Speed
 - Bin capacity
 - Noise level

Quality Function Deployment (QFD)

		Engineering Requirements									
		Weight	Volume	Cost	Noise Level	Speed	Pages at a Time	Shred Width	Bin Capacity	Competitors	
										Product 1	Product 2
Customer Requirements	Minimum Carbon Footprint		X								
	Reliable					X	X	X			
	Inexpensive	X	X	X					X	O	O
	All Mechanical System				X	X				O	O
	Cost Effective			X		X	X			O	
	Units	lbs	ft ³	\$	db	Pages/Min	x Pages/Iteration	inches	gallons		
		20-25	5	100	65	36	10	0.25	5.25		

House of Quality (HOQ)



Decision Matrix Criteria

Reliability (15%)

Cost Effective (13%)

Materials (Shredded material+10 Pages) (13%)

System Operation (11%)

Volume (9%)

Speed (8%)

Ease of Use (7%)

Stability (6%)

Bin Size (5%)

Shred Width (5%)

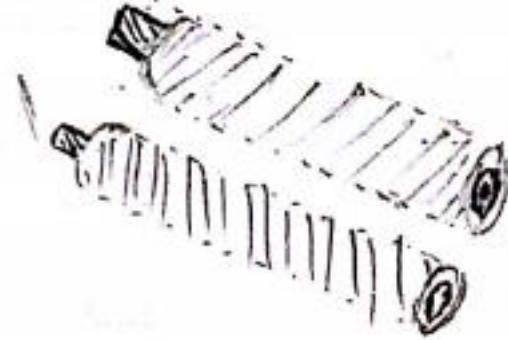
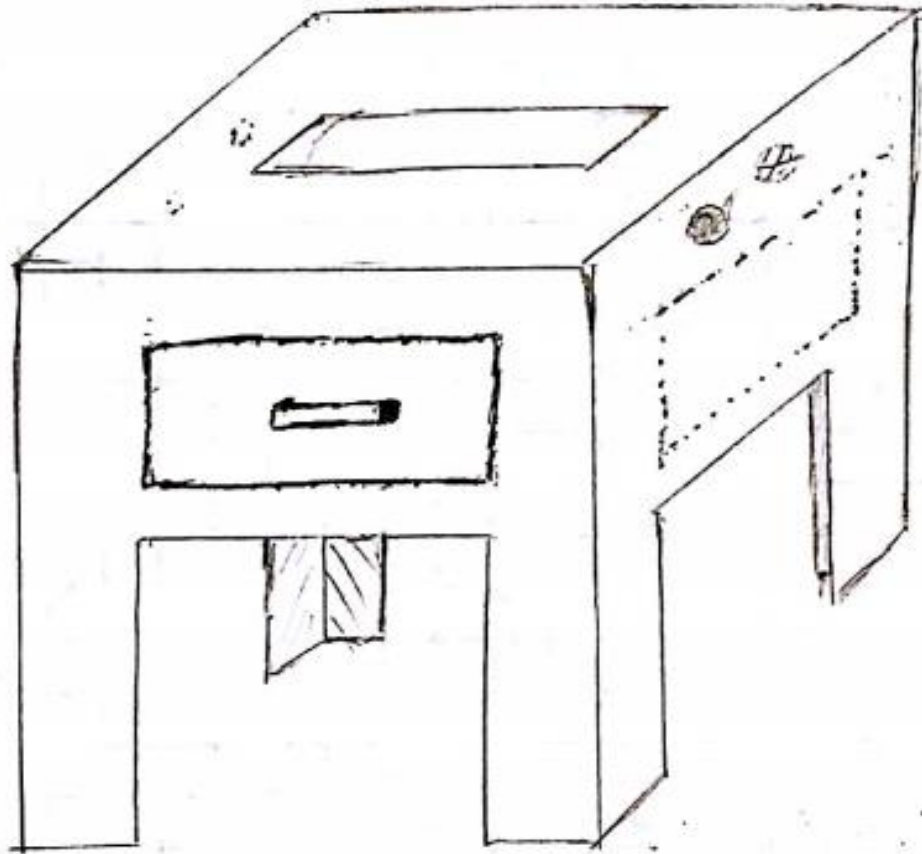
Noise Level (4%)

Portable (4%)

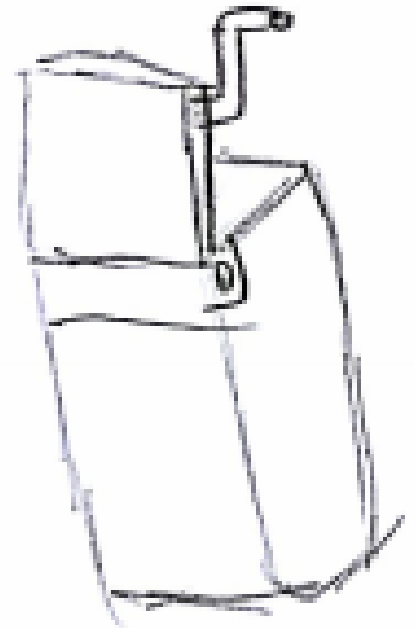
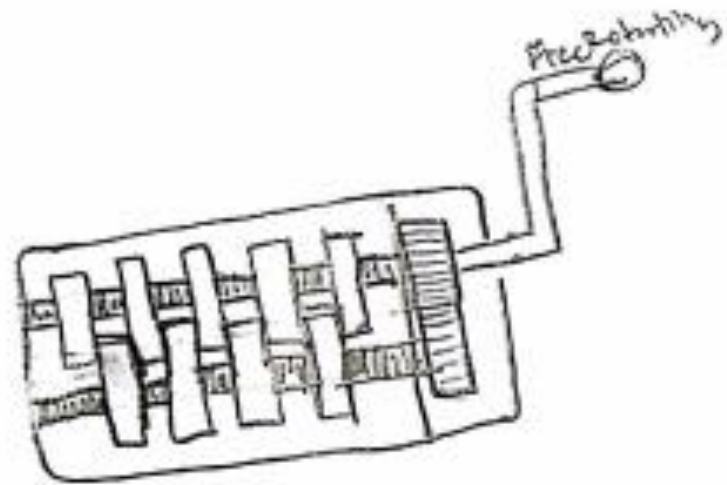
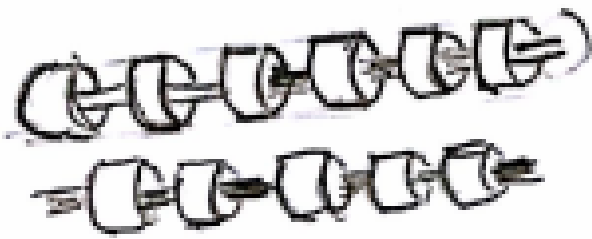
Averaged Group Decision Matrix

Group Decision Matrix Average								
Grade Scale 1-10	Design 1	Design 2	Design 3	Design 4	Design 5	Design 6	Design 7	Design 8
Reliability (15%)	1.2	0.975	1.0875	1.0875	1.0125	1.1625	1.0125	1.0125
Cost Effective (13%)	0.9425	0.8775	0.8775	0.9425	1.0075	1.04	0.8775	0.91
Materials (Shredded material+10 Pages) (13%)	1.0075	0.845	0.8775	0.8125	0.845	0.975	1.04	0.715
System Operation (11%)	0.88	0.825	0.825	0.825	0.825	0.88	0.825	0.6875
Volume (9%)	0.54	0.7425	0.5625	0.54	0.72	0.6975	0.5175	0.72
Speed (8%)	0.54	0.56	0.52	0.52	0.54	0.56	0.68	0.44
Ease of Use (7%)	0.6125	0.6125	0.5775	0.5775	0.6125	0.595	0.525	0.4725
Stability (6%)	0.51	0.465	0.465	0.405	0.465	0.45	0.435	0.3
Bin Size (5%)	0.2625	0.375	0.3375	0.325	0.4	0.3875	0.325	0.4
Shred Width (5%)	0.375	0.3625	0.375	0.35	0.3375	0.3625	0.4	0.35
Noise Level (4%)	0.28	0.29	0.27	0.26	0.29	0.27	0.26	0.24
Portable (4%)	0.26	0.26	0.24	0.31	0.35	0.34	0.24	0.34
Total:	7.41	7.19	7.015	6.955	7.405	7.72	7.1375	6.5875

Final Concept: Design 1



Final Concept: Design 6



Chosen Product

- AmazonBasics 12-Sheet Cross-Cut Paper, CD, and Credit Card Shredder
- Current Price on Amazon: \$54.99
- 8.9 x 12.5 x 15.7 inches System ~1.01 ft³
- 4.8 Gallon Bin

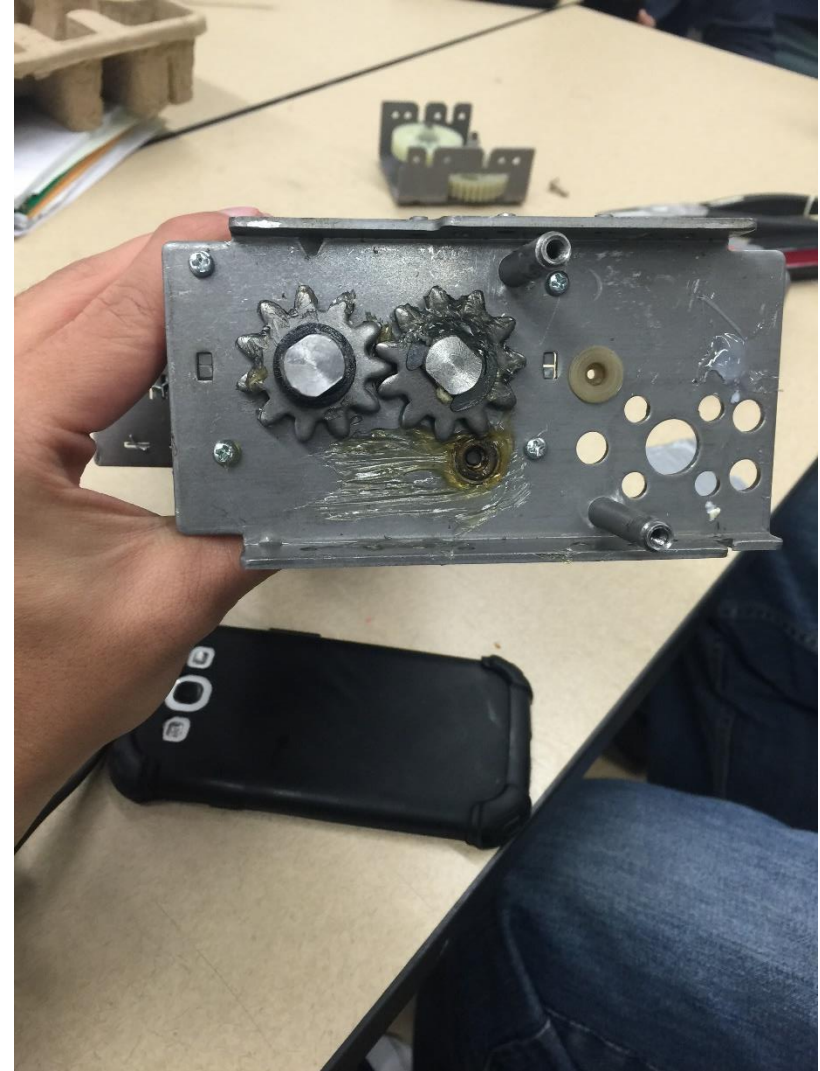


AmazonBasics Paper Shredder [1]

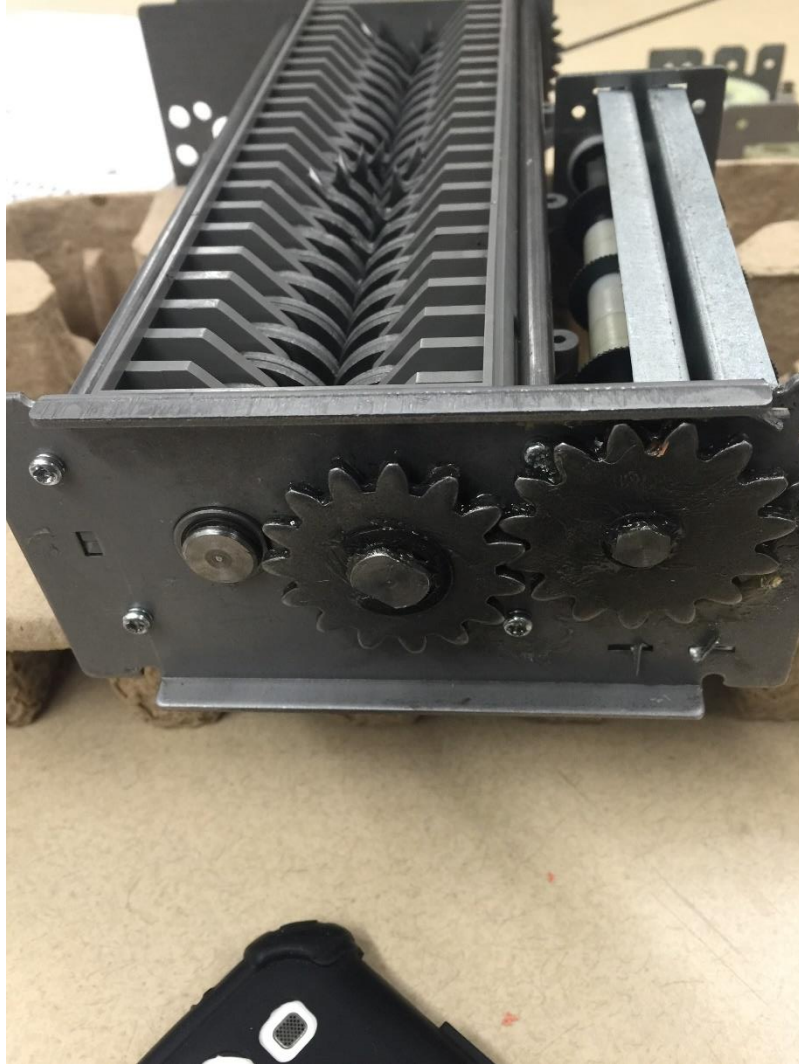
Contained Mechanism



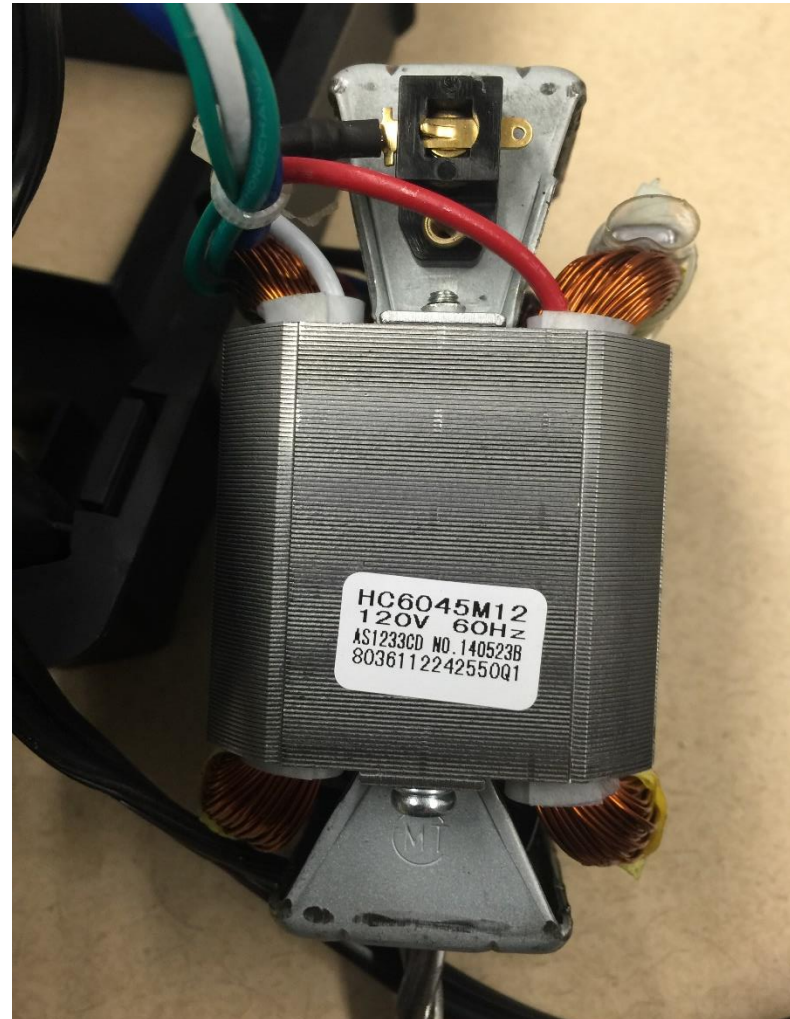
Mechanism Contained Continued



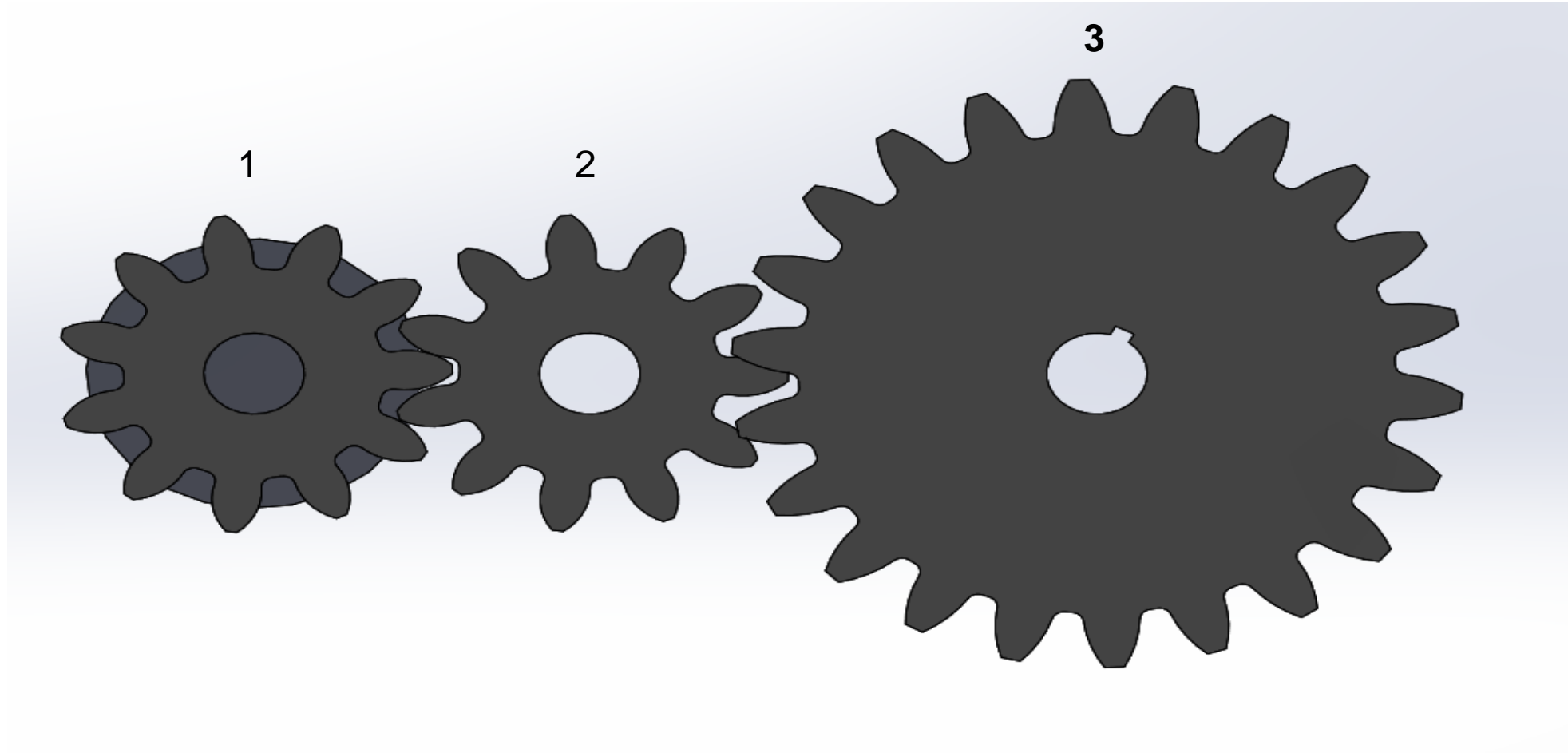
Mechanism CD Shredder



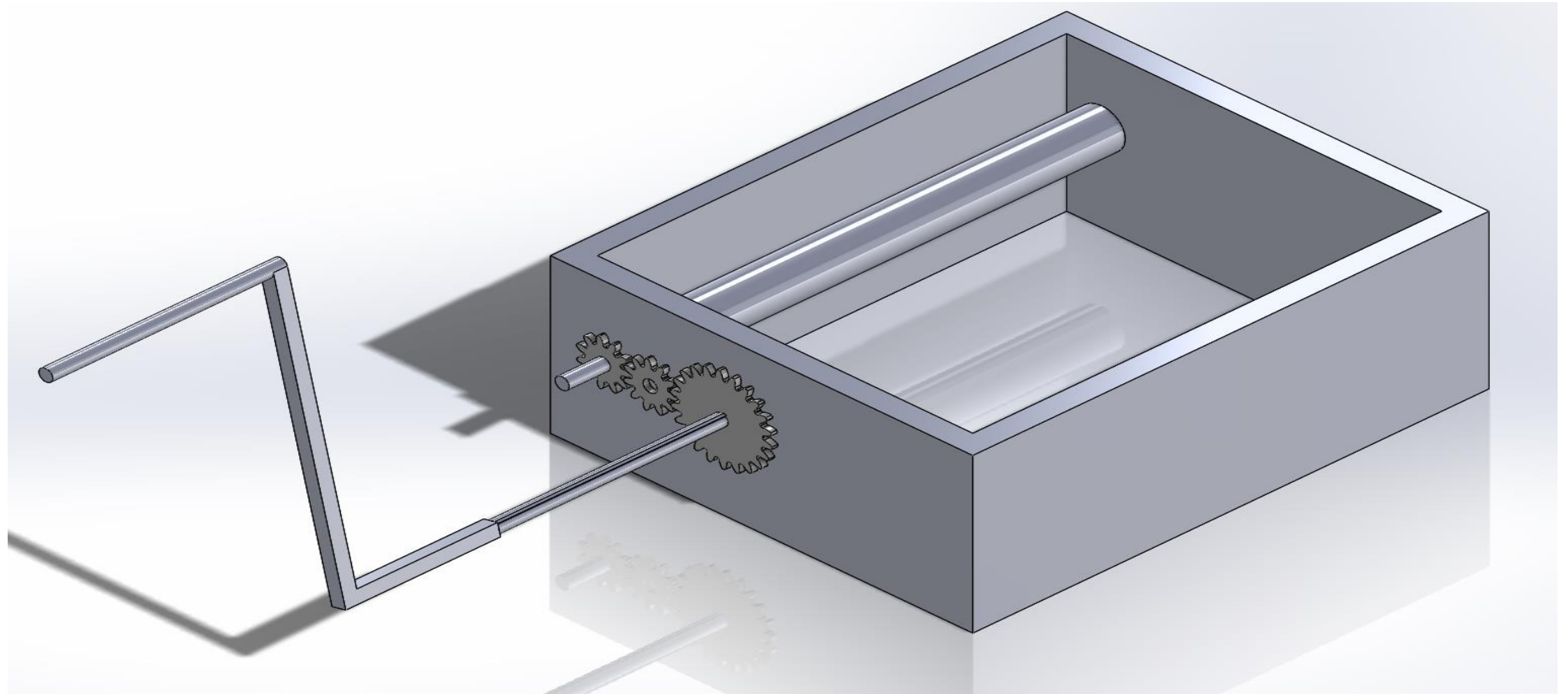
Mechanism Power Source



Gear Assembly



Hand Crank Design



List of Parts and Prices

Parts	Price
AmazonBasics 12-Sheet Cross-Cut Paper, CD, and Credit Card Shredder	\$54.99
Steel Ball Bearings	~\$6.00 each*
Steel Spur Gear	~\$25.00**
1 Aluminum Crank Handle	~\$20.00*
1 3/8" Diameter Hardened Shaft	\$4.45
	Total: \$116.44

*Estimated prices for components from McMaster.com [2]

**Could acquire as custom gear

Conclusion

- The team was given the task to retrofit a mechanical paper shredder from an electric paper shredder and construct a design to do so.
- We propose retrofitting the paper shredder with a hand-crank by installing a custom gear into the unit.
- The paper shredder will still be as effective as an electric paper shredder

References

- [1] Amazon. *Amazon Basics 12 Sheet Cross Cut Credit Shredder* [Online]. Available: <http://www.amazon.com/AmazonBasics-12-Sheet-Cross-Cut-Credit-Shredder/dp/B005QAQFFS>
- [2] McMaster. *McMaster-Carr* [Online]. Available: <http://www.mcmaster.com>