METAL SHREDDER

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BACKGROUND

Hendrickson, established in 1913, commenced operations by fabricating craned trucks and pioneered the tandem truck suspension technology in 1926. In 1978, Hendrickson became an acquisition of the Boler Company, following which the company divested its truck manufacturing operations to concentrate on suspension systems. Presently, Hendrickson is an integrated manufacturer of suspension system components and an active sponsor of the Metal Shaving Shredder project. Notably, the tube cutting process at Hendrickson produces metal shavings that agglomerate and generate wasted space and time. The design team is entrusted with the responsibility of conceptualizing and developing a metal shredder capable of shredding the metal shavings into a steel hopper for easier and safer handling. The design must conform to established safety protocols, be cost-efficient, and facilitate ease of maintenance. Figure 1 shows the founders and Figure 2 the metal shavings coming from the tube cutter.

Figure 1: ***Hendrickson Family***

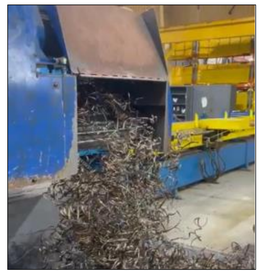


Figure 2: ***Metal Shavings***

CUSTOMER NEEDS/SPECS

Table 1 represents the needs and target specifications that were developed by Hendrickson and the senor design team/ The most important customer needs are safety and shredding ability.

Table 1: ***Customer Needs/Specs Table***

Customer Needs	Target Specifications
Safe	OSHA 1917.151
Shred Shavings	Reduce volume of shavings by 75%
Mobile	Can be moved with 1-2 personnel
Cost Efficient	Cost less than $65,000.
User-friendly	Can be facilitated by 1 peronnel
Ease of Maintenance	Require simple tools to replace parts

DESIGN CONCEPTS

Each concept was generated separately by each team member using a concept design matrix. The concepts vary by shredding methods such as blades or gears, number of shredding axes and layers, mobility, and power source.

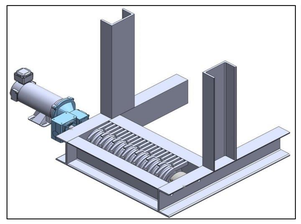


Figure 3: ***Concept 1***

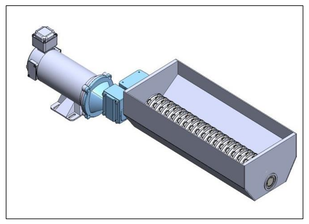


Figure 4: ***Concept 2***

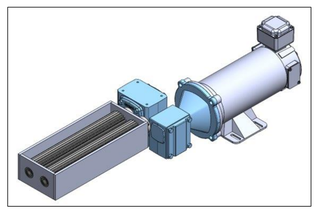


Figure 5: ***Concept 3***

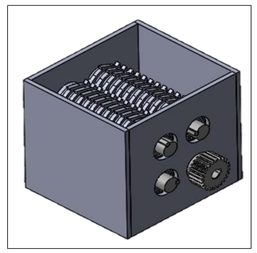


Figure 6: ***Concept 4***

FINAL DESIGN

After consulting with the sponsor, the team decided to combine concepts one and two into one design. The shredding design will be used from concept one and the angled trough design will be used from concept two. The machine will be mobile using fork pockets, include required electrical components and safety guarding (Figure 7).

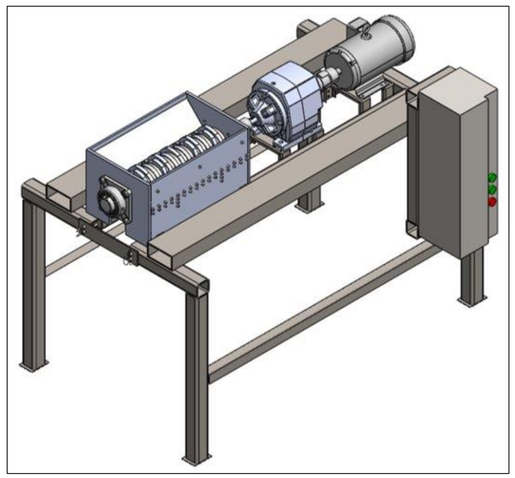


Figure 7: ***Final Design, CAD***

FINAL BUILD

Figures 8-10 showcase the different assemblies involved in the shredder, namely the shaft assembly, shredding box assembly, and the final assembly. The shaft assembly is composed of a hexagonal shaft, steel blades, and spacers. In the shredding box assembly, the box and trough are welded together, while the box is welded to the frame and equipped with steel fingers that are bolted in. The final assembly is mobile, fitted with casters and welded fork pockets on the frame. Unfortunately, the gear reducer was not delivered in time for the EXPO, resulting in the shredder not being operational. Further discussion of this will be addressed in the future work section.

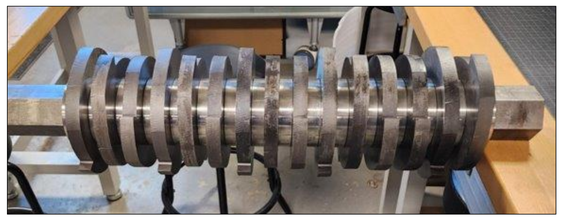
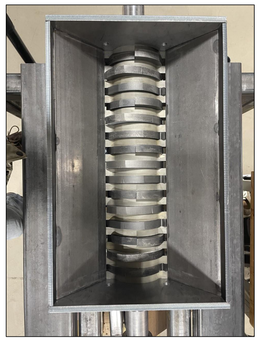


Figure 8: Shaft Assembly



Figures 9-10: Shredding Box Assembly

Figure 10: Frame

CONCLUSION/FUTURE WORK

The design team collaborated with Hendrickson to create a functional metal shredder prototype. Although the shredder currently lacks any protective guards or safety sensors, its mechanical components are nearly complete, while the electrical components are still in progress. Further efforts will entail conducting shredding and safety tests to evaluate performance and security. Additionally, a detailed electrical schematic must be prepared to ensure precise integration and operation of the shredder's electrical system. The frame should be coated to prevent the metal from rusting and improve the machines aesthetics.

Figure 11: Final Assembly

LESSONS LEARNED

1. Planning is the most important phase in project management.
2. Effective, consistent communication is an important aspect of projects.
3. Failure to understand key components can result in an unexpected delay to project progress.
4. Projects with larger budgets can take longer to be approved, so that time must be accounted for.
5. Part tolerances and material finish affect lead time and cost.

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