ROCK CRUSHER

Improving the design of a rock crusher to be used in Northern Uganda. Able to repeatedly crush rocks after four years of capstone teams.

Figure 1 Rock before being crushed

OVERVIEW

- The current process of creating gravel for concrete is extremely labor intensive in Uganda - it consists of people smashing rocks with hammers or larger rocks, which is both unsafe and inefficient
- The goal of this project is to create a design for a human powered Jaw crusher that is able to be built in Uganda.
- This is the fourth iteration of this project, continuing off of analyses and tests from previous teams, the rock crusher is now able to consistently crush rocks.

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Figure 2. Rock after being crushed

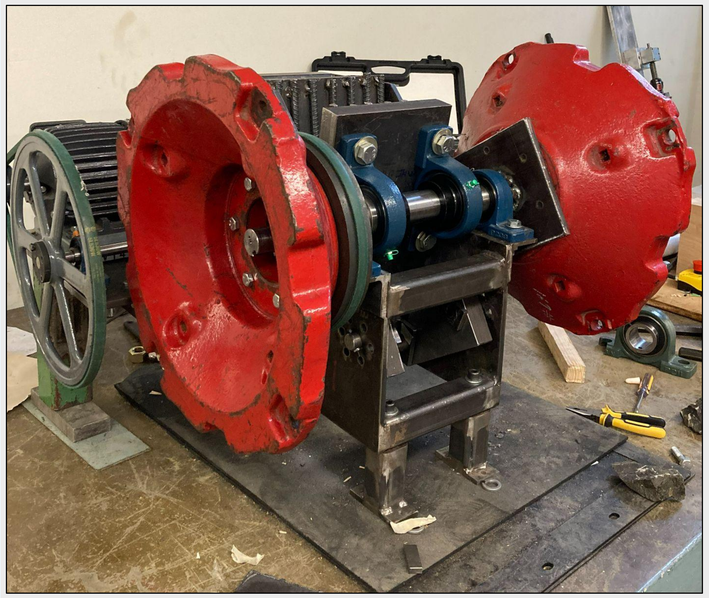

Figure 3. Rock Crusher

FUTURE IMPROVEMENTS

- Replace the motor with a human powered pedal system or stepper machine
- Design and implement a toggle plate to replace lower linkages and improve overall durability
- Build custom bearings to increase overall strength at an affordable cost
- Replace rubber pulley belts with roller chains to eliminate slippage

IMPROVEMENTS

Increased Strength and Durability: Increased the sizes of the jaw plates, linkages, and eccentric shaft to raise the overall strength of the crusher. Replaced hollow jaw plate pillow blocks with solid ones

Analyses: Multiple finite element analyses performed to determine component sizes, locations, and material types

Testing: Able to run crusher at extended periods of time and determine places for improvement

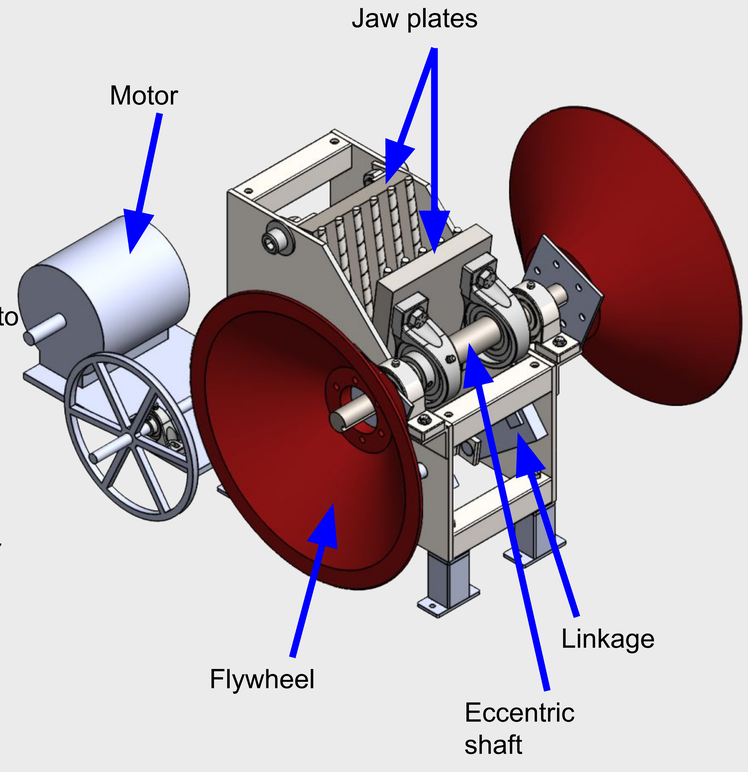

Figure 4. CAD model with labeled components

DESIGN

- Based on industrial jaw crusher designs with a four-bar linkage defining the motion of the moving jaw.
- Heavy flywheels store energy over a long period of time, increasing the ergonomic aspect of the system.
- Frame walls laser cut from a single piece of steel, allowing for simple assembly and multiple options for component placement.
- Solid 2-in. steel eccentric shaft allows for 0.5-in.of throw, mitigating the risk of bending within the system
- Rebar on the face of the jaws reduces the amount of slippage from the rocks, increases the stresses within the rocks, and controls the final size of the aggregate.
- 1.5-in. thick jaw plates gives the crusher the strength to withstand the high forces without being deformed
- Four bearings distribute the load from the shaft to the jaw plate and reduce the chances of bending

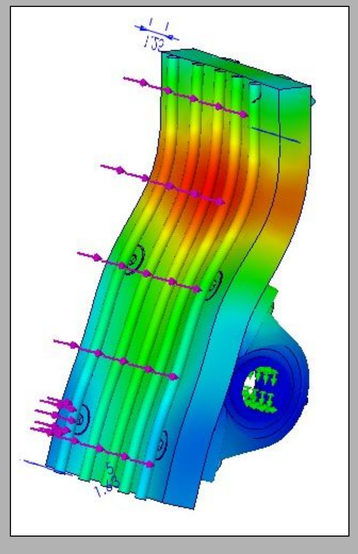

Figure 5 FEA of forces on Jaw plate

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