MODIFIED PALLET JACK

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ABSTRACT

Pokagon State Park is in Steuben County, Indiana and the Park receives pallets of firewood shipped by enclosed semi-trailer. For the park to get pallets out of the truck, because the lack a loading dock, the staff is currently dragging pallets out with a chain connected to a skid steer. The current method that is used is inefficient and labor intensive and is likely to break the pallet. Figure 1 shows what a typical pallet would look like.

Figure 1: Firewood Pallet Storage

The task was to design and build a device that is easy to use and limits the number of workers required to 2 people. What is unique about the team's design is that there is currently nothing like it on the market. The skid steer can use its forks to pick up the pallet jack and be utilized without any loss in function to the forks. The device locks onto the forks with a spring-loaded pin mechanism which secures the pallet jack to the forks when in use. The device is easily removeable from the forks and can be used as a standard pallet jack to pick up pallets of wood in the trailer. The device reduces the number of workers to two, less labor intensive, more efficient, and eliminates the likeliness of the pallet breaking.

CUSTOMER NEEDS/SPECS

Tables 1 and 2 show the needs and specifications determined for the project after consulting with the team sponsor and evaluating the design problem.

Table 1: Customer Needs

Needs
Product must reach pallets in the back of the trailer
Must be able to move a pallet without damaging it
Integrated so it does not limit the current functionality of any Bobcat Feature
Average person will be able to understand the product with little explanation of how it operates

Table 2: Project Specifications

Specifications
Can move pallets 53 feet from the back of an enclosed trailer
Device must be lifted by a bobcat
Device must be able to lift a 1200 lb. palleted load
Must be done using only 2 people
Can fit under a pallet with room on either side of the forks
The locking mechanism needs to be easy to lock and unlock

DESIGN CONCEPTS

The team pitched four concepts to the sponsor: Figures 2-3 are the Hydraulic Winch and T-Bart Pallet Puller, Figures 4-5 the Beaver Squeezer and Pallet puller, Figures 6-7 the Modified pallet Jack system, and Figures 8-9 are the Electric Winch and Reverse Scissor Puller.

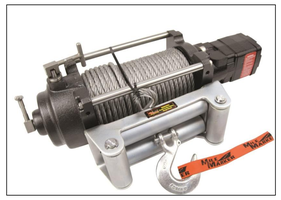

Figure 2: Concept 2 – Hydraulic Winch

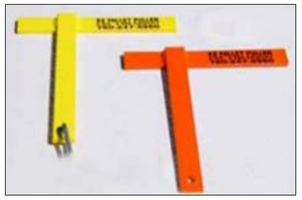

Figure 3: Concept 2 – T-Bar Puller

Figure 4: Concept 3 – Beaver Squeezer

Figure 5: Concept 3 – Pallet Puller

Figure 6: Concept 4 – Pallet Fork Extensions

Figure 7: Concept 4 – Concept Sketch

Figure 8: Concept 1 – Electric Winch

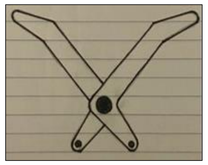

Figure 9: Concept 1 – Reverse Scissor Puller

TEST RESULTS

The FEA on the cut pallet forks was conducted using SolidWorks and a load of 1,200 pounds. The test resulted in an acceptable factor of safety of 3.6 (Fig. 10), and a maximum deflection at the tip of the pallet forks of 0.55" (Fig. 11). The pallet jack is rated for 5,500lbs and did not undergo any further tests by the design team.

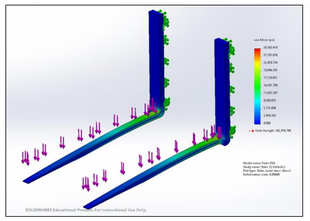

Figure 10: Stress/FOS

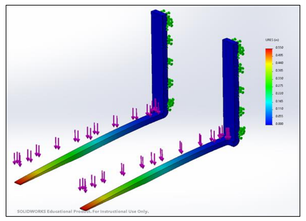

Figure 11: Displacement

FINAL DESIGN

After communicating with the team sponsor, developing a concept solution, and manufacturing the solution, the team is left with the final project design seen below. Figure 12 shows the 3D model of the team project before manufacturing and Figure 13 shows the Final Project design.

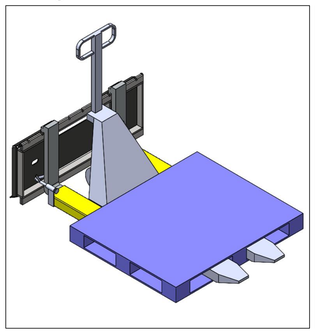

Figure 12: Final 3D Model

Figure 13: Final Design

FUNCTION TESTS

The team and park staff completed several functional tests of the new pallet movement system at the park service area. Figures 14 to 16 show the system in action.

Figures 14-16: Device in Use

CONCLUSION

The team has assembled a fully functional pallet jack system for Pokagon State Park. The team has used the design phases of this project effectively to produce a low-cost solution for Pokagon. This device allows for the workers at Pokagon to efficiently unload pallets of firewood from the back of an enclosed semi-trailer. In the figure above, the modified pallet jack is utilized by the bobcat and operator to pick up a full pallet of firewood.

LESSONS LEARNED

With the conclusion of the project, the team learned:

- Problem solving skills
- How to document the progress of the solution
- How to manage and solve a design problem
- Engineering design processes and methods
- Professional skills

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