

ABSTRACT

At Color Master Inc, in Butler, IN, color concentrates and pigments are manufactured and shipped out to customers. The pigment is contained in 55-gallon drums as seen in Figure 1, which was previously moved around the factory floor by being rolled around manually on the bottom edge of the drum, Figure 2. This solution is unsafe and needlessly strenuous on the workers. Color Master had drum dollies on site, but the process required to use those is not efficient or convenient. The students developed a solution to this problem: a new drum handling device that meets these requirements. This device also has the capability to lift the drum high enough to be placed on the scale and tumbler and is also compact and maneuverable enough to fit inside the tumbler cages on the factory floor.



Figure 1: 55-Gallon Drum

Figure 2: Rolling a Drum

CUSTOMER NEEDS/SPECS

Color Master needs a lifter that will execute the required tasks safely and efficiently. Table 1 lays out all of the customer needs and specifications for the engineering design.

Table 1: Customer Needs and Specifications

| Customer needs | Target Specifications |
|--|---|
| Safer method of drum movement | Vertical lift of up to 10" - 12" |
| Device can be easily stored | Minimum capacity of 275 lbs. |
| Ability to move drums quickly and smoothly | Secure & handle standard 55-gallon drum |
| Method of raising & lowering drums | Less than 100 lbs. |
| Device is aesthetically pleasing | Device dimensions: 36" x 36" x 31" |

DESIGN CONCEPTS

Using a concept selection matrix, the team chose to move forward with four final concepts, which can be seen in Figures 3 – 6. These concepts were created by each team member and brought to the Color Master management team for the project and presented. After the presentation Color Master chose the final concept, which was the Fulcrum Cart seen in Figure 5.

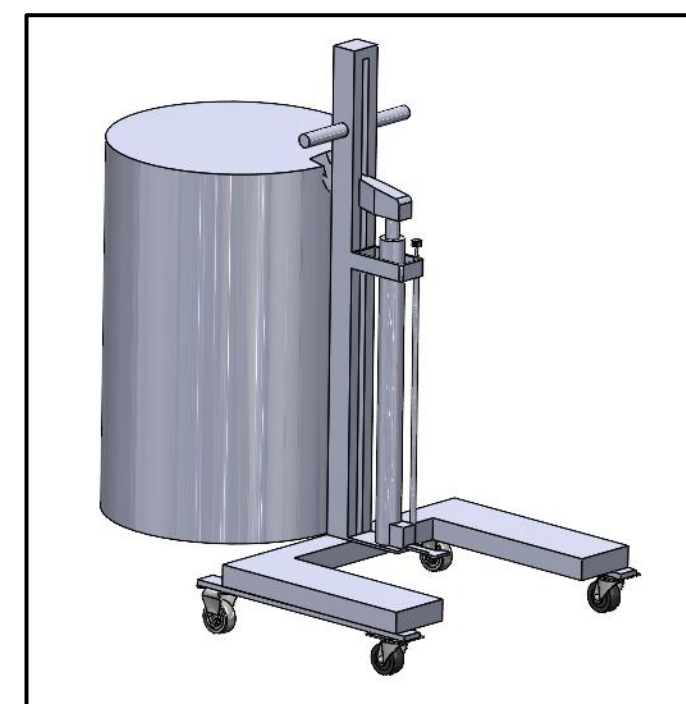


Figure 3: Hydraulic Foot Pedal Lifter



Figure 4: Swivel Crane Cart



Figure 5: Fulcrum Cart

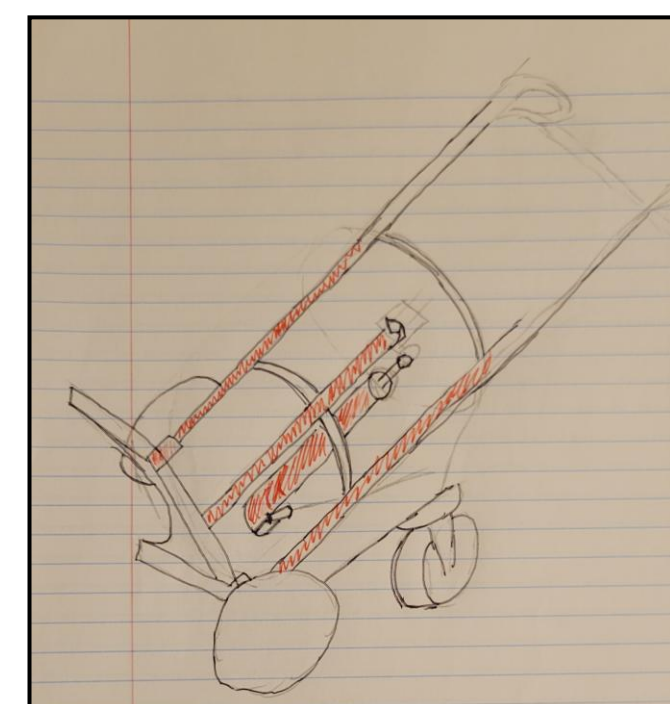


Figure 6: Modified Dolly

TEST RESULTS

The team conducted two major testing sessions, the preliminary testing held in the foundry, and the primary testing at Color Master's facility in Butler, IN.

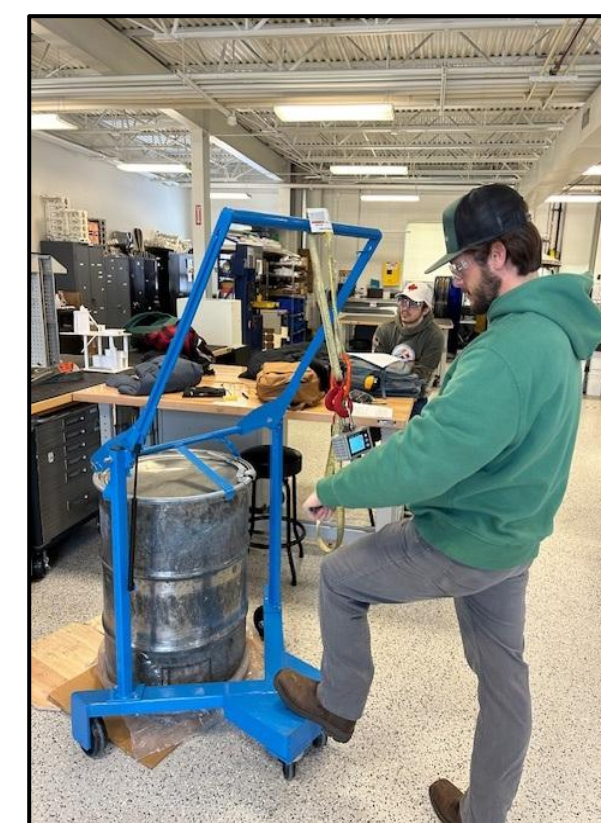


Figure 7: Preliminary Testing



Figure 8: Primary Testing

Seen in Figure 7 & 8, both tests were a success, but the primary testing revealed one crucial refinement that was needed: more reach due to the discovery of a scale that the company used that was not previously unknown.

MODIFICATIONS

As seen in Figures 9 – 14, these are the modifications the team had to make to conform the lift to the sponsors needs for proper use at the facility.

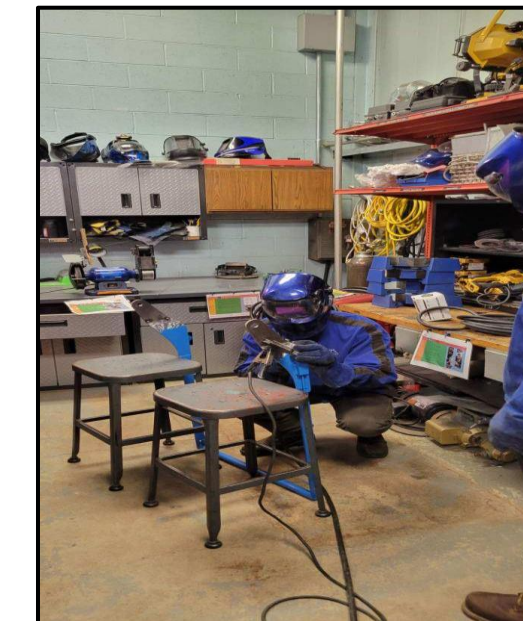


Figure 9: Tabs Welding



Figure 10: Bracket Welding



Figure 11: New Parts



Figure 12: Frame Markings



Figure 13: Frame Modification



Figure 14: Pusher Mechanism

FINAL DESIGN

The final CAD model design is seen in Figures 15 & 16 for the mechanism with all modifications incorporated into the design. Using this the team could run any FEA needed to ensure the design would be safe for the operator. Using this model the team could ensure that all dimensions and modifications would fit and work as it should when the actual mechanism was completed.

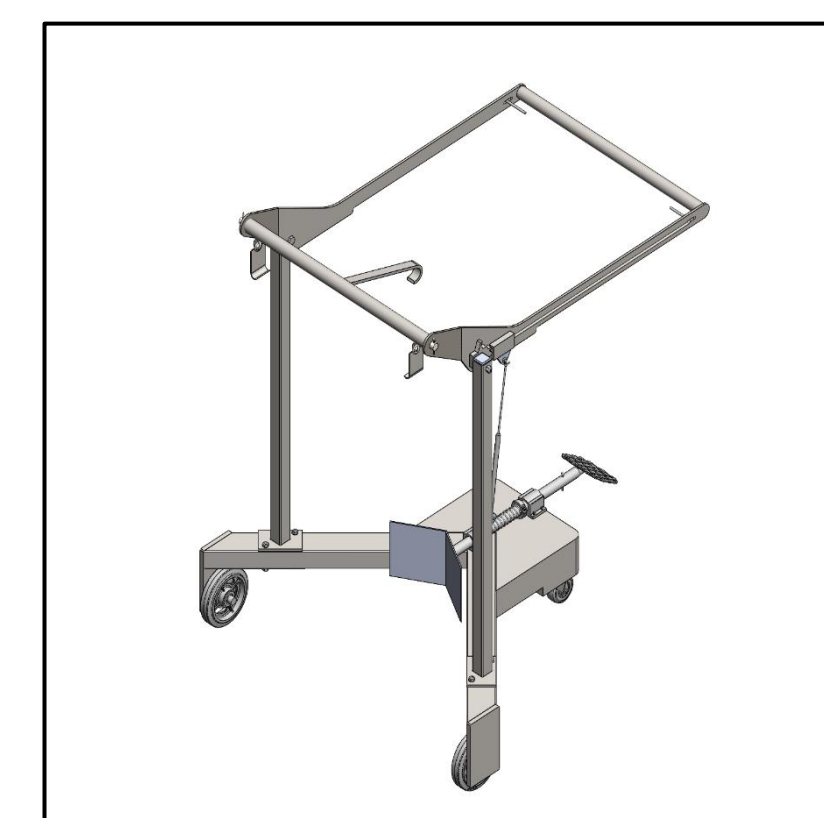


Figure 15: Final Design

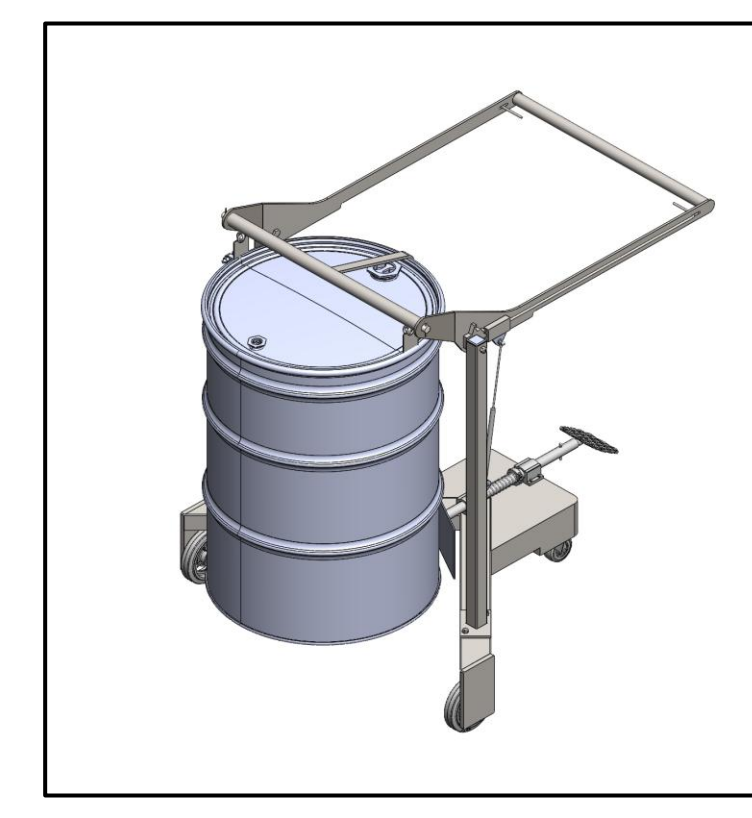


Figure 16: Final Design With Drum

CONCLUSION

The team has gone through the engineering design process to create a mechanism that will be safer and efficient for the Color Master to utilize. The team followed a phase schedule to ensure completion of the project. The device works by the locking the 55-gallon drums to the three hooks and allowing the operator to manually lift the barrel via a Fulcrum. Then allowing for various heights and easy maneuverability. The team believes this mechanism will meet all of Color Master's needs for safe and efficient movement of the drums. Figures 17 & 18 show the final artifact.



Figure 17: Final Artifact



Figure 18: Final Artifact With Drum

LESSONS LEARNED

The team has learned valuable things throughout the duration of this project:

- Problem solving skills involving real world scenarios.
- Developing this product requires great communication amongst the team members as well as using outside resources.
- Working/communicating with an external customer paying money.

ACKNOWLEDGMENTS

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