PART STACKER

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Design Engineering Technology
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INTRODUCTION

The project sponsor for the building of the part stacker is B. Walter & Co., more specifically Scott Buehrer the president of the company and Justin Holley the lead engineer. The problem that B. Walter & Co. is currently confronting is the downtime caused by stopping a press operation that punches out two brackets each second. The effects of this operation at B. Walter & Co. is having multiple operators to keep up with the stacking of brackets and making the operation more time consuming than what the sponsors want. Figure 1 is the current process where the operator

Figure 1: Current stack process.

Figure 2: Shows the Go No Go Gauge

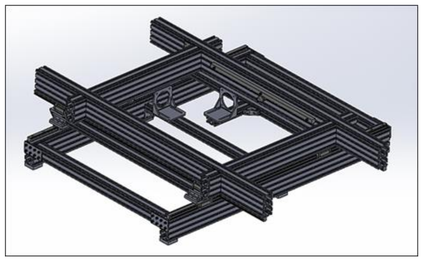

Figure 3: Last year's design.

hand stacks the brackets. The process is time consuming and labor intensive. Figure 2 is the current gauge used to determine if the brackets are fit for sale. Figure 3 is the model from last year's design. The previous model is not sufficient for the automation process.

CUSTOMER NEEDS

Based on sponsor input, the team developed a revised list of customer needs as shown in Table 1. These needs illustrate the sponsors interest in this machine for production use.

Table 1: Customer needs list

Reliability- run consistently and long service life operation	Ease of use- minimal training to operate, swift set up, and easily storable
Safety- no sharp edges, overhangs, and a e-stop button	Cost- keep the cost proficient while maintaining reliability
Efficient- keep up with stamping rate, brackets stacked orderly, and reduce operator involvement	

DESIGN REVISIONS

The part stacker design from last year had three layers with an X and Y direction movements powered by two stepper motors, Figure 4, on a rack and pinion system. The motor is wired in parallel to provide max torque and speed to the part stacker. The top layer allowed one pallet to lay on top with two bins for the left and right-side brackets.

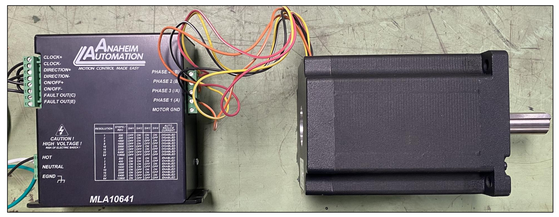

Figure 4: Driver and motor wired

A new slide to guide the left and right-side brackets into the two bins is needed for the automation process. The slide will be fabricated form 16-gauge sheet metal to provide strength and durability in an industrial setting. The 2D slide is shown in Figure 5. Other design revisions include new

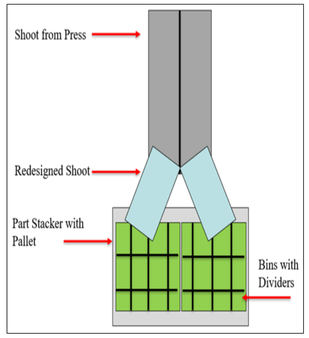

Figure 5: Initial slide design.

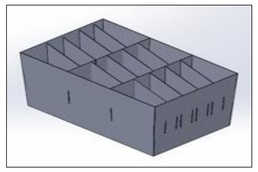

Figure 6: Initial bin design.

Figure 7: Final bin design.

bin dividers fabricated for the large and small brackets. The 3D model and final product is shown in Figures 6 and 7. Figure 8 is the EMC unit and new power cord that is added to the electronics.

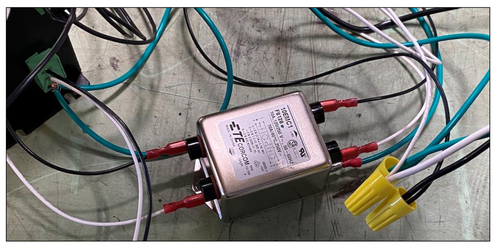

Figure 8: EMC and power cord wiring

TESTING

The team worked on testing the proposed slide design for effective release of the brackets, Figure 9. The slide has evolved with a few iterations to the one shown. The redesigned slide to allow the brackets to be stacked in the bin dividers effectively. Carriage plate prototypes were cut from wood blocks to allow for the slides to index correctly with the motors installed, Figure 10. Mounts made from steel plate will be fabricated for the final frame. 3D printed

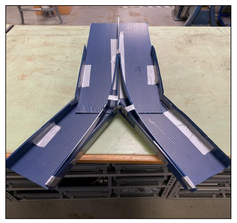

Figure 9: Slide prototype.

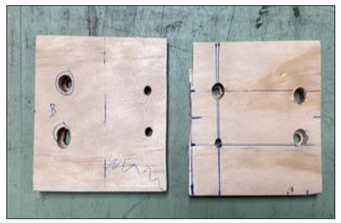

Figure 10: Carriage plate prototypes.

motor mounts will be used to hold the motors, Figure 11. Figure 12 shows the frame with the plates added.

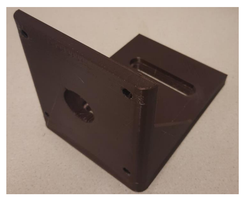

Figure 11: Stepper motor mount.

Figure 12: Part stacker frame.

AUTOMATION CONTROL

For the automation process, the team will use NEMA 42 Y stepper motors along with the drivers, EMC units, and an Arduino board that will control the motors, drivers, and will index the bins once a pocket in the bin dividers is filled. Using the electronics, the team moves the part stacker after a set number of brackets fall down the slide. Figure 13 shows the board and switches that are used.

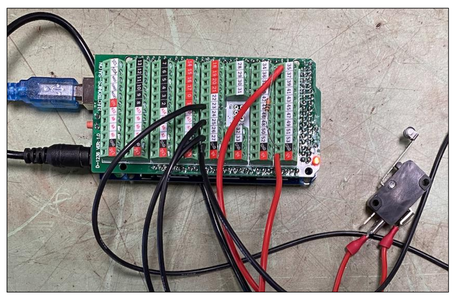

Figure 13: Arduino board and switch

FINAL DESIGN

The team is working to complete the final design of the part stacker and test its function with at the sponsors company facility before graduation. The electronics and programming of the stepper motors has proven to be a challenge. The team believes this device will provide an automated process to stack and organize the large and small brackets. The part stacker will also incorporate new slide and bin dividers to ensure all brackets are properly organized in material totes. Finally, new motors and drivers will be used to allow fast movement and stacking.

CONCLUSION

Despite the challenging times of a worldwide pandemic, the team handled the project as best as possible. The Part Stacking project allowed the team to innovate, communicate, time manage, problem solve, and become experts in different engineering disciplines besides design. These disciplines include fabrication, electrical, and programming. The project provided real-life applications to prepare the students for industry career opportunities after graduation.

LESSONS LEARNED

The team realized several lessons from working on this project:

- How to approach unforeseen problems
- Adapt to unforeseen situations
- Organization and documentation provide understanding for all parties
- Communication is the most important tool to find and provide information

ACKNOWLEDGEMENTS

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