Heat Sealer Station Ergonomics Project Summary

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Introduction

Cottonwood Industries employs individuals with a variety of disabilities. Cottonwood recruited a team to solve a design challenge for an assembly line used to produce military straps. The sponsor has asked the design team to improve the ergonomics of the workstation that heat seals plastic bags which encase the military strap. The goal is to develop a better method to transport the sealed bag and strap two feet vertically to an existing conveyor belt. Current practice uses manual labor to raise the bagged strap to the existing conveyor, often causing the worker to physically stand in order to place the strap in the desired position. The motivation behind this project is due to Cottonwood employing workers with physical and mental handicaps, who find the stamina and strength required to work the station difficult to handle. Decreasing the fatigue accumulated during a shift would positively impact production levels and the overall safety and health of the employee. The design process includes initial background research, acquisition of design criteria, generation of concepts, analysis of concepts, and selection of the concept that best fits the requirements of the customer. After the selected concept was further investigated, a pivot was made to better accommodate the requirements of the customer.

Initial Design Direction: Lift/Conveyor

When the project was initiated, the production line was not in use for observation. Initially, the team considered several lift conveyor systems to eliminate the overhead lifting by workers at the heat sealer station.

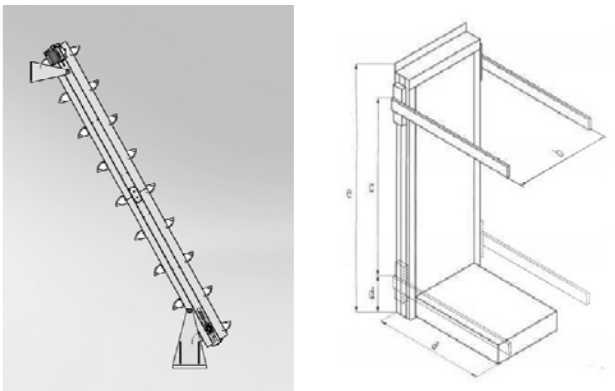

Figure 1: Early concepts

Final Design Approach

When the team witnessed the line running, many issues with the proposed automatic lifting device were made clear. The existing conveyor belt did not run continuously, as was previously thought. The conveyor is controlled by a single quality control worker, who runs the assembly line for a few seconds every couple minutes in order to obtain a few straps at a time. Thus, straps would tend to pile up, instead of forming a single file line on the conveyor, which is needed because stacks two or more high would bind the conveyor. Thus, the design was re-examined and a new approach was taken to solving the overhead lift exertion by station workers.

Discussions with the liaison and various other company employees brought up an opportunity to make modifications to the station instead of creating a separate device to add to the station. Desired alterations to the station include: reducing reaching height of the conveyor for the workers without forfeiting efficiency, allow the heat sealer workers to continue to sit during heat sealing, and keeping the overall order of the assembly line. The connection of the heat sealing station with the quality control station also posed some concerns, as the seamless movement between the two sections of the line would need to remain.

Final Design Summary

Lowering Conveyor Height

Lowering the convey was relatively simple, due to the telescoping tubing that supports it. The height reduction came from the elimination of dead space, as shown in Figure 2. Only minor modifications were needed to accommodate the transition to the quality control table. The conveyor was lowered by 7.5 inches, enough to reduce arm strain and allow most workers to remain seated when placing straps on the conveyor belt.

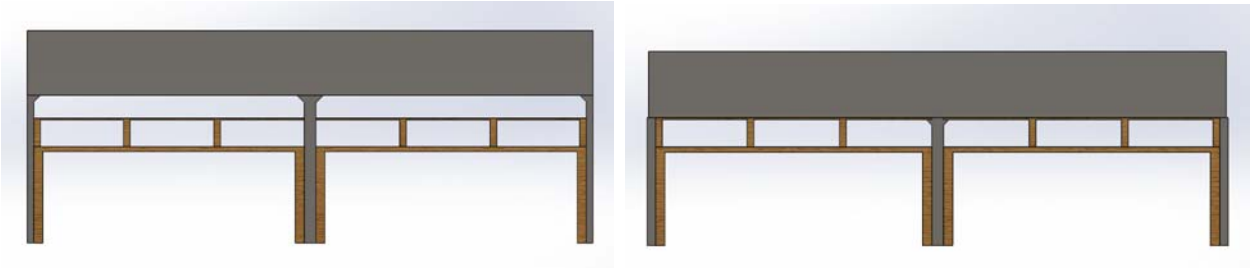

Figure 2. Conveyor height reduction from the original (left) to the final (right).

Strap Platform

The strap platform will be implemented to hold the strap while the heat sealer is sealing the plastic bag enclosing the strap. The platform would position the strap at the correct height and distance away from the heat sealing device. As seen in Figure 3, the top surface of the platform includes a stop block to hold the strap when the bag opening is pulled over the stop block. Rectangular PVC (1”x2”) tubing will make the frame and stop block of the platform. L-brackets with one hole on each flat surface will be screwed to the connecting corners of the platform to hold the device together. The top surface will be stainless steel. Adhesive-backed rubber stripping will be used to cover any sharp edges.

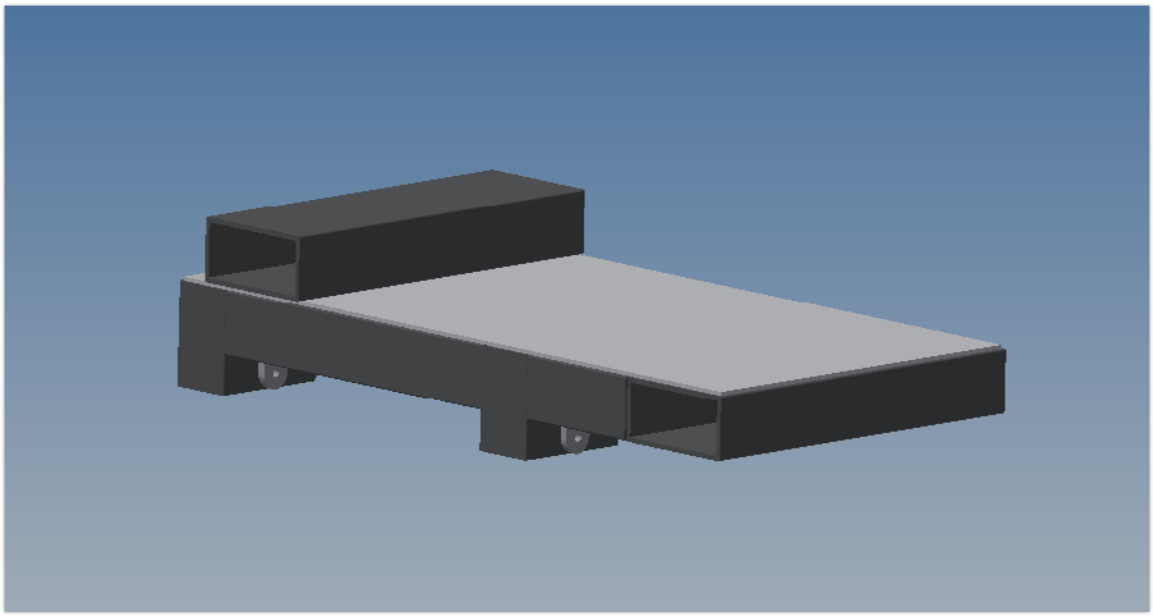

Figure 3. Strap Platform

Strap Delivery Device

The strap delivery device shown in Figure 4 will replace the current incoming strap shelf. These devices will be placed between each set of heat sealers to allow the previous station to advance straps through the guided lanes in the strap delivery device. The straps will arrive within reach of the heat sealing station workers to be sealed. The station workers would then be able to place the straps on the lowered, existing conveyor belt. The strap delivery device will also be made of rectangular PVC (1”x2”) tubing for the lanes and supports. Aluminum will be used as the sliding surface for the straps to be delivered through the work station. L-brackets and screws will hold the device together. Adhesive-backed rubber stripping will be used to cover any sharp edges.

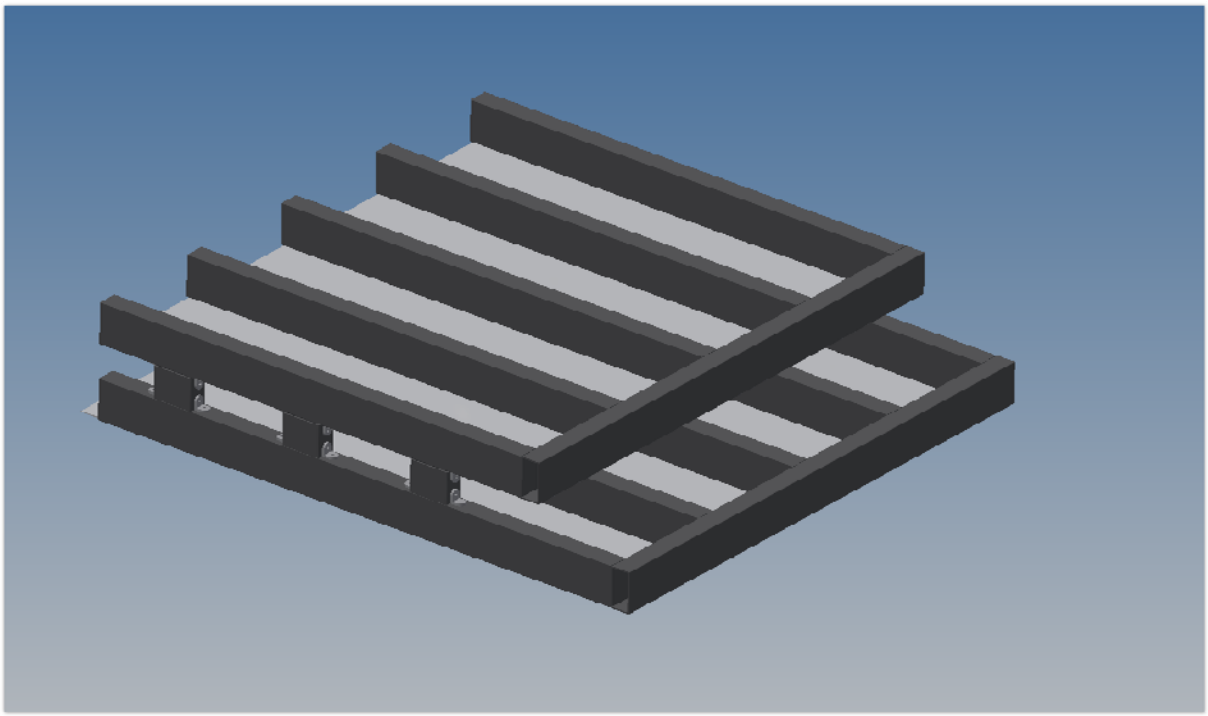

Figure 4. Strap Delivery Device

Modified Project Budget

The project was completed at a cost of $960. Each strap platform cost $75 in materials and each strap delivery platform cost $240 in materials.

Final Product

The last products to be delivered were given to Cottonwood during the final presentation, May 6, 2014. The fully modified heat sealer line is now more organized and ergonomic (Figure 5). The strap platforms are also much sturdier than the previous cardboard platforms.

Figure 5. Heat sealing line with all modifications.