Automated Edge Rounding of Steel Sheets

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Abstract

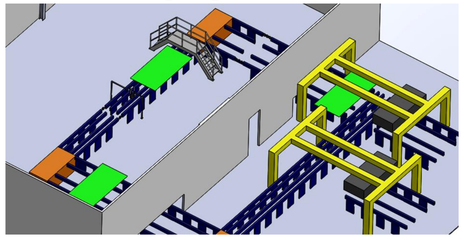
The purpose of this project is to propose a device to CST Industries that can round the edges of their steel sheets of various gauges and dimensions. Ultimately, the team's research and proposed designs have allowed CST to move this project forward more quickly. Based on the team's recommendations, CST contracted a custom machine designer to get the bulk of their CNC device fabricated. This company plans to have the system installed over the summer.

Introduction

CST Industries is a worldwide company that produces large storage silos. These silos are comprised of sheets made of structural steel. CST uses a proprietary porcelain enamel coating to color and defend these sheets from the elements. However, the enamel cannot effectively coat surfaces with sharp geometry. In order to ensure that the steel sheets will be coated evenly, all the edges of the sheets must be rounded. CST currently does this rounding using a combination of sanding, rolling, and hand beveling. However, this is very costly due to the time and manpower required to use the rolling and beveling techniques. Alternatively, CST's sanding operation, which is reserved for only the thinnest gauge sheets, is completely automated and far more efficient. The end goal of this project is to incorporate a bulk material removal process into the sanding line in order to round the edges of all sizes and gauges of material.

Methods and Materials

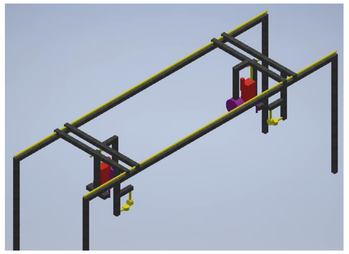
CST's steel sheets have a range of gauge sizes of .228"-.5". CST's existing sanding line translates the sheets with a combination of conveyors and rollers. The sheets pass by sanding belts to remove material from the edges, creating the desired rounded profiles. The proposed solution will round the edges of all of CST's sheet gauges and sizes.



Results

The proposed solution has four main systems: a milling system, an adjustment system, a tolerancing system, and a support/guide system. The milling system is what removes the bulk material from the sheets. This system uses custom milling bits and an adjustable milling spindle. The adjustment for this system will be CNC controlled by a 2-axis structure. This structure will be highly rigid in order to remove chatter that could ruin the tooling. Because of the how expensive custom tooling can be, the goal of the tolerancing system is to provide precise adjustment to the spindle in order to account for variance within the sheets. This will be done using cam rollers equipped with distance sensors to send real time data to the actuation system.

To reduce chatter, support rollers will be placed on either side of the spindles in order to hold the sheets rigidly while being worked on. This, and the bits themselves, will generate a large amount of friction, making it difficult for the conveyors to effectively pull the sheets through the devices. To combat this, large motor-driven wheels will be used to pull the sheets through the devices in a controlled manner.



Discussion and Conclusions

Ultimately, once constructed, the proposed device will be able to accomplish the task set out by CST Industries. The proposal submitted by the team has moved CST forward in their ability to streamline their edge rounding process. The only work that CST has left is to find the proper tooling contractor to produce the required custom tooling.

Acknowledgements

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