Design and Construction of an Automated Sand-blasting Cabinet

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PROBLEM
Several steel parts used on one of Genie's scissor lifts (see images to the right) are plasma cut. The plasma-cutting process leaves a thin oxide scale on the parts. The scale is not strongly adherent and after painting may fall off in the field, leaving exposed steel vulnerable to corrosion. Grindscape Engineering was given the task of developing a machine which would fit into the flow of Genie's assembly line and quickly remove the oxide scale prior to welding and painting of the assembled lifts.

NEEDS
The requirements for the machine were:
• The part must be descaled in less than 2 minutes
• Must be capable of "throw-in loading"
• Doesn't release harmful fumes/dust into the air
• One touch unload
• Is at an ergonomic distance in both height and depth from operator
• Employs compressed air at 100 psi or 110 V AC as its power source
• Is no wider then 12" and no deeper then 24"

SOLUTION
The first step in developing an adequate solution to the problem was a visit to Genie's Renton production facility. An important purpose of this visit was to understand the Toyota Production System used by Genie and the particular requirements of designing a machine for this system.

Each group member created seven possible solutions to the scale removal, the specialized method of holding each part and the test to ensure the machine worked, in accordance with the Toyota Production System philosophy.

Of the large number of ideas brainstormed three machines were selected for final consideration and were built as wood mock-ups: A sandblasting unit, a grinder and a vibratory miller.

Sandblasting unit wood mock-up
Pros of sandblaster design:
• No moving parts
• Quick removal of scale
• Simple maintenance
Cons of sandblaster design:
• Possible release of dust
• Machine noise

Interior view of grinder wood mock-up
Pros of grinder:
• Very simple part insertion
• No environmental hazard
Cons of grinder:
• Complex moving parts

Vibratory mill wood mock-up
Pros of vib. Mill:
• Easy to design
• throw-in loading
Cons of vib. mill:
• Lots of waste produced
• Slow removal rate
• Difficult part retrieval

Final Selection: Sandblaster (with modifications—the best aspect of the grinder, the slot insertion feature was adopted for use in sandblaster)
Reasons: No moving parts, process already used commonly, high scale removal rate.

PROTOTYPE CONSTRUCTION
The cabinet was fabricated entirely by group members.

Wood mock-up
Early in fabrication stage
Nearly completed prototype with circuitry