Lathe Modification For Disc Machining

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Background

- McKay Industries manufactures agriculture and railway parts
- Project focuses on doubling 13” Shark-tooth disc production to 300k/yr
- Design modifies vertical turning lathe (Doosan Puma V550)
- Key focuses are retrofitting the grip system and cutting tool attachment

Design Focus (Criteria)

- Self-centering, work-holding mechanisms for a disc
- Customized cutting tool, turret attachment
- Reduced cycle time
- Component parts designed with a factor of safety > 4
- Ease to manufacture, assemble and maintain
- Ease of operation
- Modular design for potential new products (unique disc profiles)

Design Comparison

Current System

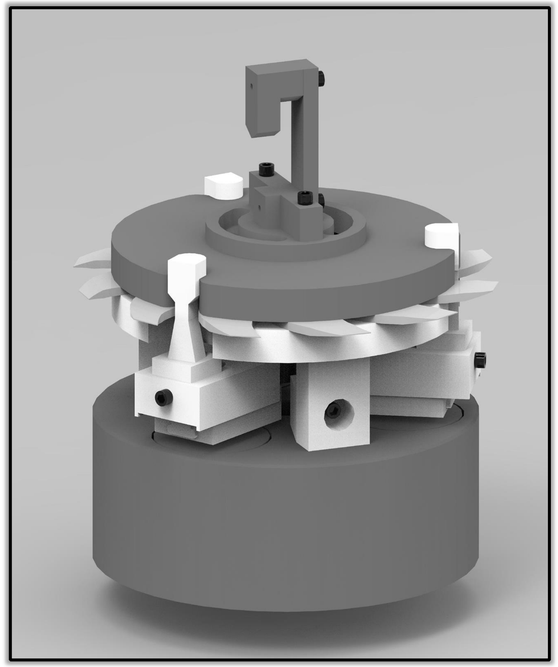
- Hydraulic clamping by two chucks
- Difficult to achieve and maintain center alignment
- Limited rotational speed
- Disc not secured horizontally

Proposed System

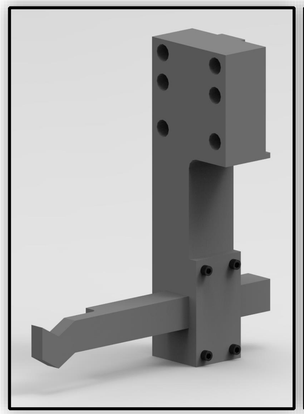
- Mechanical, automated 3-jaw chuck clamp
- Self-centering feature
- Improved productivity (rpm capacity doubled)
- Secured disc (mechanism locks disc)

Final Design Assembly

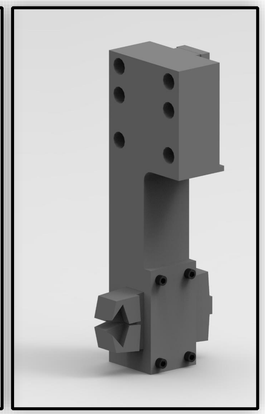
(26 Custom Designed parts)



Chuck Assembly



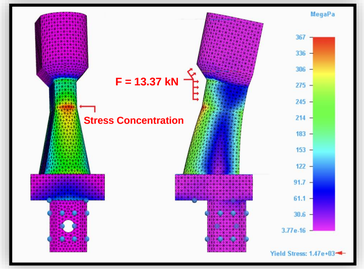
Top-plate attachment



Cutting tool attachment

Stress Analysis (FEA)

Top Jaw Insert (holding piece)



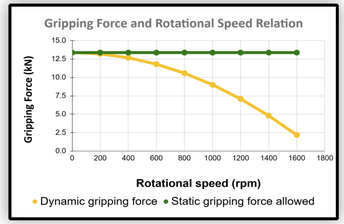
Simulation link

Material:

- Viking tool steel
- Allowable Stress: 367 MPa
- Yield Strength: 1470 MPa
- Applied Force: 13.4 kN

Results

Projected Production Cost Analysis	
For lathe-related production	
Design Implementation	$66,000 CAD
Annual raw material cost	$1,200,000 CAD
Annual labor cost	$104,000 CAD
Annual sales	$2,700,000 CAD
Annual profit	**$1,330,000 CAD**



Conclusions

- Industry-approved design: ready for manufacturing and implementing
- Future scope: integrating automatic palletizing/depalletizing with lathe

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