Problem Statement

- The mounting and unspooling process is hazardous and has room for improvement, stemming from the method of spool loading and unloading.
- Fragile graphite furnaces can be compromised by oxidization.
- Scrap must be melted twice to avoid shortening the life of the equipment.
- Desire to create a better unspooling device so that scrap can replace cathode use completely.

Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
<th>Deviation</th>
<th>Measurable</th>
<th>Verifiable</th>
<th>Testing</th>
<th>Results</th>
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</table>

Solidworks FEA Modeling

- Analysis for all load bearing members, with multiple tubing thicknesses.
- Adequate thicknesses were chosen to satisfy 10 factors of safety.

Testing & Results

- 7 tests conducted at the IMC plant include:
  - Standard weight test
  - Safety arm effectiveness test
  - Worst-case drop test
  - Durability over time

  None of the tests resulted in any deformation or breakage, the chassis held up adequately under the full 7560lb weight and remained unharmed through the duration of testing.

Design with roll inserted (Above); Design of roller at the factory (Left side)

Safety Lever mechanism (Above)  Exploded view of all cradle components (Right)

Business Case Analysis

- Total Project Cost – $15,000
- Estimated Annual Savings – $328,500
- Project Payback Timeframe – 16.67 Days
- Implementation of the cradle allows IMC to use scarp copper instead of cathode. A second cradle could be implemented on a sister furnace.

Future Work

- Lengthen safety lever boom (above)
- Lengthen safety lever base (above)
- Add tracks to lever boom for smooth operation (above)
- Reverse grease valve direction (above)
- Flip rollers periodically (left)
- Shorten gap between rollers (left)
- Addition of VFD and wench with table (misc)

Team & Acknowledgements

- Team 10 – Andrew Otto ME, Sarah Shepherd ME, Andrew Self ME, Carlos Velazquez ME
- Sponsor --------- IMC Metals – Brad Rudolph
- Mentor .................. Dr. Hugh Jack