Problem Description
To satisfy a market need for a skid loader with an increased height capacity.

Importance of project
An extension will allow the ability to stack hay bales higher than currently possible, utilizing full capacity of storage facilities.

Final Goal
Achieve 12 ft lift height while maintaining stability and load rating.

Objectives
- Perform finite element analysis on telescoping loader structure
- Use statics to determine proper balance
- Incorporate new hydraulic components
- Build functional prototype

Design Components
Structural Extensions inside current lift arms.
Hydraulic system to control extension
Center of gravity calculations for ballast
Electrical hydraulic control
Prototype Manufacturability
Design Methodology

Pro Engineer
- Computer model to aid in Design
- Conceptual image of Prototype
- Allows for FEA to be performed in ANSYS

ANSYS
- Stress and Deflection Analysis of new extension
- Stress Analysis of original lift arms due to new loading
- Verification of Loading Conditions “Hand Calculations”

Hydraulic System
- Design for application speed
- Design for rated pressure and flow
- Worst loading conditions

Counter Balance
- Calculate center of gravity
- Optimize location of weights
- Limit weight of machine

Prototype Production
- Modification of Machine
- Fabrication of Extension arms
- Integrating new Hydraulic System
- Painting

Important Calculations
- Beam Deflection
- Lift Force
- Hydraulic Flows
- Weld Calculations
- Center of Gravity

Pro Engineer computer model of the full structural design

ANSYS computer stress analysis of the full structural design

New hydraulic flow dividers and DCV

First test of the hydraulic system

First test of the extension arms

Important Numbers
- System pressure = 2500 psi
- Rated Load = 1850 lbs
- Design cycles = 150,000
- Max deflection = .87 in
- Max Stress = 27,900 psi
- Machine Weight = 4500 lbs
- New Machine Weight = 5000 lbs
Final Prototype Checklist

- Painting: Complete
- Hydraulic system: Complete
- Counter balance data: Complete
- Mechanical structure: Complete
- Electrical system: Complete

Conclusion

Working prototype that achieves a 12 ft work height.
A full extension of 3.5 ft.
The machine’s stability is maintained.
Market for new design: 12% storage capacity in Hoop Barns
Total Cost for Modifications: $4050

Future Design Considerations

- Account for hydraulic fittings in design
- Design extension cylinders to be inside of extension arms
- Addition of a plastic wear plates inside extension
- Grease fittings for extension arms
- Incorporating a second torque tube

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