“Revolution” Modern Steam in the Making

AST CONFERENCE OCTOBER 2023

“Revolution” Progress Update

- Summary of Build Progress
- Chassis Trials

Introduction

- Progress:
  - Getting There - Slowly
  - “September Flurry”
- Rolling chassis
  - It Rolls!
- 2025 Deadline
  - Doable with help and support
  - A challenge to rise to!

Summary – The Build So Far…..

- Main Frame
  - Machined by John Dunn
  - Difficult to set up
  - A 5 Axis machining centre with 2m bed would have been handy…..

Photo: John Dunn

Summary – The Build So Far…..

- Main Frame
  - Machining

Photo: John Dunn

Summary – The Build So Far

- Pony Truck
  - Simple adjustment of spring and centring force
  - Assembly complete
  - Trial fitted

Summary – The Build So Far

- Suspension
  - Main components complete
  - Key parts given Arcor finish:
    - Thermo-mechanical treatment
    - Salt bath nitriding +
    - Oxidising passivation
    - Smooth black finish
    - Wear resistance
    - Surface hardness
    - Corrosion resistant

Summary – The Build So Far

- Rods
  - Complete set of connecting and coupling rods
  - Machined from Aluminium Alloy – very light
  - Anodised
  - Bearings fitted

Wheelsets

- Assembled

Wheelsets

- Tyres being turned

Photo:
John Dunn

Wheelsets

Cylinders - History

- Originally conceived as a fabrication
  - Many plate/tube/bar components
  - Plenty of weld
  - Minimal mass
- Re-designed as a casting
  - 3D printed patterns
  - Improved functionality

Cylinders - History

- Grant Soden's 3D printed trial
- However….
- Original steel casting very expensive with potential risk
- Change to SG Cast Iron and bolted steam pipe connection
  - Still very expensive
- And then…

Cylinders - History

- During the 2022 AST Conference (over a single malt)…..
- A new concept emerges (inspired by the P2)
- The “Minimal Weld Fabrication”
  - Only (7) components
  - Machined from steel to a high level of detail and accuracy
  - Incorporating as many features as possible at component level
  - Fabricated using only simple, minimal welds (cheap) – self jigging
  - Only finish machining of bores and ends required after assembly
  - Full functionality
  - No patterns required.
  - Mostly made using own facilities

Cylinders

- Section through steam passages
  - Passage milled into End Plates
  - Closed off by the valve chest and barrel
- Components accurately located in pockets

Cylinders

- ValveEnds
- Made from 4” Square bar

Cylinders

- Valve Centre
- Made from 4” Sq bar

Cylinders

- End Plates
- Water Jet cut from 40mm steel plate
  - No hard edges.

Cylinders

- End Plates

Cylinders

- Barrel
- Made by Statfold Barn Eng.

Cylinders

Kit of Parts

Cylinders

- Welded Assembly
- Fab by Metalworld Engineering
- Stress relieved
- Final boring to be completed.

Cylinders

- Trial Fit

Rolling Chassis

- Suspension
- Trial fit of coupling rods
- Bearings checked
- Rotation checked

Rolling Chassis

- Trial Fit of:
  - Frame
  - Springs
  - Pony Truck

Roller Guide Bars

- Revised design
- No handed parts (almost!)
- Simplified machining

Roller Guide Bars

Roller Guide Bars

Boiler

- Alex Powell
- Design Calcs
- Component CAD modelling started

Footplating

Livery – Robin Barnes

Build Summary – So Far…….

- 130 Manufacturing Drawings
- 5843 CAD Files created
- 274 Components Manufactured

Stapleford Chassis Trials 27/28 September 2023

Chassis Trials

- Check rod clearances
- Load up chassis
- Weigh axles and check spring adjustment
- P=80kg + L=238kg + C=230kg + T=255kg Total = 803kg (1200kg)
- Pony truck behaviour
- Driving axle behaviour
- Approx 8 miles running
- No serious issues

Loaded Chassis

Chassis Trials

Pony Truck Motion-Vertical

Pony Truck Motion - Lateral

Pony Truck - Springs

Pony Truck – Findings

- Generally performed as expected
  - Soft springs minimise coupled axle unloading
  - Aligns well to track curvature
- Side play control may need to be increased
  - Provision for additional control springs designed-in
- Free pivoting spring caps and guides to prevent buckling
- Yet to do:
  - Static control force measurement
  - Safety straps and guard irons

Coupled Axles - Vertical

Coupled Axles - Trailing

Leading Coupled Axle – Side Play

Coupled Axles – Findings

- Generally performed as expected
  - No evidence of wheel unloading
  - Aligns well to track curvature
- Rear springs may need to be slightly softer.
- Rod clearances OK
- Axle load can be equalised and adjusted at the pony truck.

At Speed!

Next Steps

- Complete boiler CAD modelling – drgs for manufacture
- Manufacture valve gear
- Manufacture brake gear
- Finish bore cylinders and make liners/pistons etc.
- Design smokebox and draughting
- Complete Tender / Cab design
- Publicity – SR article
- Fund raising…..

Thank You!