Rapid Manufacturing of Casters

Sponsored by Colson Associates

CONCEPT

- Reduce lead time
- Focused on simplifying design
- Tried starting from scratch
  - Designed 2 possible concepts

- Less parts = Less failure points
- Less manufacturing processes and machines
  - Cutting → Water Jet
  - Crimping → Roll Forming
  - Turning → CNC Machine
  - Assemble stage → Welding machine

Torque Spherical Caster: Design 1

COMPONENTS

- Top plate:
  - Raw Material: Standard Steel
  - Manufacturing Process: Water Jet
  - Function: same in existing mechanism

- Thick Wall Tube:
  - Raw Material: Steel thick wall tube
  - Manufacturing Process: Water Jet/ Laser and Crimping
  - Function: contain roller balls and main sphere

- Main Sphere
  - Raw Material: Need to experiment
  - Manufacturing Process: Need to experiment
  - Function: Hold in roller balls and act as the "wheel" in current caster designs

- Roller balls: Standard steel balls
  - Function:
    - Work as a bearing and eliminates need for torque in turn
    - Transfer vertical load
    - Holds main sphere in place

Torque Spherical Caster: Design 2

COMPONENTS

- Top plate:
  - Raw Material: Standard steel
  - Manufacturing Process: Water Jet
  - Function: same in existing mechanism

- Thick Wall Tube:
  - Raw Material: Steel thick wall tube
  - Function: Act as raceway for balls and house main sphere

- Main Sphere
  - Raw Material: Need to experiment
  - Manufacturing Process: Need to experiment
  - Function: Hold in roller balls and act as the "wheel" in current caster designs

- Roller balls: Standard steel balls
  - Function:
    - Work as a bearing and eliminates need for torque in turn
    - Transfer vertical load
**BASIC CONCEPT**

- Standard bearings
  - No Heat Treatment
- Less manufacturing processes and machines
  - Cutting → Water Jet
  - Turning → CNC machine
  - Assemble stage → Welding machine
  - Corrosion protection → Powder coating

**CONCEPT 2**

- **Bearing**: Standard available in market
  - Function: Allow the sealed action, Transfer vertical load

- **Bearing Housing**: Raw Material: Steel
  - Function: Hold Outer race of bearing and fork

- **Top plate**: Raw Material: Steel
  - Manufacturing Process: Water Jet / Laser
  - Function: same as existing mechanism

- **Queen Pin**: Raw Material: same as used in King Pin
  - Manufacturing Process: CNC – Turning
  - Function:
    - Hold (Top plate/Inner race)
    - Lift fork and reed assembly upward

- **Fork**: Raw Material: Steel
  - Manufacturing Process: Water Jet / Laser
  - Function: same as existing

  - Straight fork which needs least machining but need to be heavy.
  - Bent fork, which needs only simple bending and which is moderate in weight.
  - Profiled or bubbled fork which needs critical bubbling but with least material.

**BRAKES**

- Easily attached to Bearing Housing
  - Screwing
  - Locking System

**ADVANTAGES**

- Heat Treatment is not required.
- All components can be made by turning and water jet or laser cutting, within hours.
- No special tooling required for different products.  
- Customized items can be made faster by simply modifying computer programs. 
- Ideal for small batch sizes of 500 to several thousand pieces. 
- Low inventory.
**BASIC CONCEPT**

- Use of CNC Turning, Milling, and Cutting
  - Creates flexible manufacturing
  - Eliminates need for hard tooling and stampings.
  - Removes need for forging processes and associated forging dies.
  - Eliminates requirement for casting processes and required cores.

- Remove Process of Welding
  - Eliminates need for special welding fixtures
  - Reduces cost between use of skilled workers vs. assembler.

- Multi use of laser
  - Cutting
  - Precise heat treatment

**LASER HEAT TREATMENT**

- Provides accurate heat treatment
  - Good for bearing races
- No surface coating required
- Rapid self quenching with appropriate thickness...
- Relatively low-power Nd:YAG lasers can be used
- Multi function of laser for cutting and heat treating processes.

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**FLEXIBLE DESIGN**

![Diagram of caster components](image)

- UPPER RACE
- STEM
- BALL BEARINGS
- SPACER
- LOWER RACE
- FORK
- WHEEL

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**FLEXIBLE DESIGN 1**

- SCREWS
- MGT PLATE
- UPPER RACE
- BALL BEARINGS
- SPACER
- LOWER RACE
- FORK
- WHEEL

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**FLEXIBLE DESIGN 2**

- SCREWS
- MGT PLATE
- UPPER RACE
- BALL BEARINGS
- SPACER
- LOWER RACE
- FORK
- WHEEL