The Steam Engine

- Pre-Steam
- Boilers
- Atmospheric Engine
- Condensing Engine
- Double-Acting Engine

Pre-Steam

- Hero of Alexandria
  - 1st Century AD
  - Described Boiler and Reaction Turbine
  - No Suggestion for Useful Application of Device
- 16th Century - Descriptive Publications
- 17th Century - Beginning of Steam’s Practical Usage

Hero’s Engine

Boilers - Types

- Shell (1720s)
  - Kettle on Stove
  - Inefficient - Loss of Heat
- Heat Tube (1750s)
  - Tredgold - London
- Fire Tube (1750s)
  - Limited in Capacity and Pressure
  - Susceptible to Explosions
  - Smeaton
  - Trevithick (1804) - 65 psi, 25 inch bore, 10 ft stroke

Boilers - Types (continued)

- Improved Water Tube (1850s)
  - Wilcox (1856)
    - Multiple, helical Water Tubes
    - Better, Water Circulation
    - More, Heating, Service
  - Babcock & Wilcox (1866)

Boilers - Construction

- Materials
  - Copper
  - Cast Iron
  - Rolled Iron Plates - 5/16” (1795)
  - Steel
- Fabrication
  - Bolts & Rivets
  - Welding
Boilers - Explosions
- Poor Materials
- High Pressure
- Pressure Release
- Theoretical Considerations
- Fabrication Techniques - Rivets
- High Heat Input
- Poor Distribution of Heat
- Direct Heating
- Poor Circulation

Haycock’s Shell Boiler (1720)

Tredgold’s Heat Tube (1750)

Blakey’s Water Tube Boiler (1766)

Smeaton’s Fire Tube Boiler (1770)

Wagon - Shell Boiler (1769)