THE SECOND AGE

The Farmer, The Smith, The Wheel

Social Influences of Copper and Iron
- The Common ground
- The wheel
- Glass
- Gearing
- Early machines in Egypt
- Greece & Rome
- The Dark ages

Introduction
- Nomadic hunter to agricultural villager
  - End of last ice age brought life (10,000 BC)
  - Wild wheat and goat grass
  - Wheat, barley, & millet was harvested
- Villages grew to cities
  - reed & mud, unbaked clay, baked brick
- Animals were domesticated
- Copper, tin, & bronze (Mesopotamia)

The Common Ground
- Metallurgy became the common ground
  - Society needed food
  - Farming community needed tools
  - Metal workers became skilled craftsmen
  - Mining of Ores (Copper, Tin, Iron)
  - Construction of Furnaces & Crucibles
  - Bellows (3,000 BC) from skins/hides
  - Transportation (wheel !) industry grew

Plough
- Not possible in Copper age
- Improvement of hoe for tilling
- Caschrom - lightweight man-plough
- Animal-drawn plough (3,000 BC)
Egyptian Hand Digging Instrument (1500 BC)

Tools From Early Metallurgy
- Plough
- Copper Nails & Rivets (Egypt, 2500 BC)
- Iron nails used in ships
- Woodscrews (Roman, 400 AD)
- Shears (Egypt, 4500 BC)

The Wheel
- Used for transporting heavy loads
- Evolved from potters wheel
- First was stone?
- Solid wood
- Spoked
- Axle - Egyptian war chariot

Transporting Heavy Loads

Stretcher

Sledge
Ur (3,500 BC)

Mercurago

Egyptian (1500 BC)

Assyrian (700 BC)

Greek (400 BC)
Etruscan (400 BC)

Roman (300 BC)

Etruscan (300 BC)

Plaustrum (200 BC)

Roman (100 AD)

Leonardo
Pneumatic Studded (1907)

Gearing
- Purposes
- Friction - no teeth (Aristotle, 384 BC)
- Materials
  - Wood - large units transmitting power
  - bronze or brass - timekeeping, astronomy
  - Lanthorne & trundle
  - Helical gears (Robert Hooke, 1666 AD)

Early Machines in Egypt
- Hero of Alexandria (BC/AD)
  - Lever (3000 BC)
  - Wheel & Axle (3000 BC)
  - Wedge (3000 BC)
  - Pulley (700 BC) - Not used in pyramids
  - Screw

Chinese
- Cast iron (350 BC)
  - 13 centuries before the west
- Double-acting box bellows
- Steel (100 BC)
- Papermaking (100 AD)
- Gunpowder
- Little technology transfer to west despite “Silk Road”

Greece
- Heavily dependent on slaves
- Great builders
- Architecture
- Scientists instead of technologists
  - Mathematics, Astronomy, Philosophy
  - Not great inventors
  - Archimedes
- Horizontal waterwheel (Norse mill)
  - 0.5 horsepower

Architecture - Parthenon
Horizontal Waterwheel

Roman
- Heavily dependent on slaves
- Vertical waterwheel (Vitruvius, 180 AD)
  - 3.0 horsepower
- Bridges & roads
- Aqueducts
- Water usage
  - 270 liters per person per day
  - Lead pipes
  - Fall of Roman empire

Vertical Waterwheel