Introduction to Engineering

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Introduction to Engineering

- This session will introduce Engineering to the students.
- This session is composed of five sequences:
  1. Definition and History
  2. Engineering Disciplines
  3. Successful Engineering Skills
  4. Case Study: Moon Landing
  5. Greatest Engineering Achievements of the 20th Century

1.1 Definition and History

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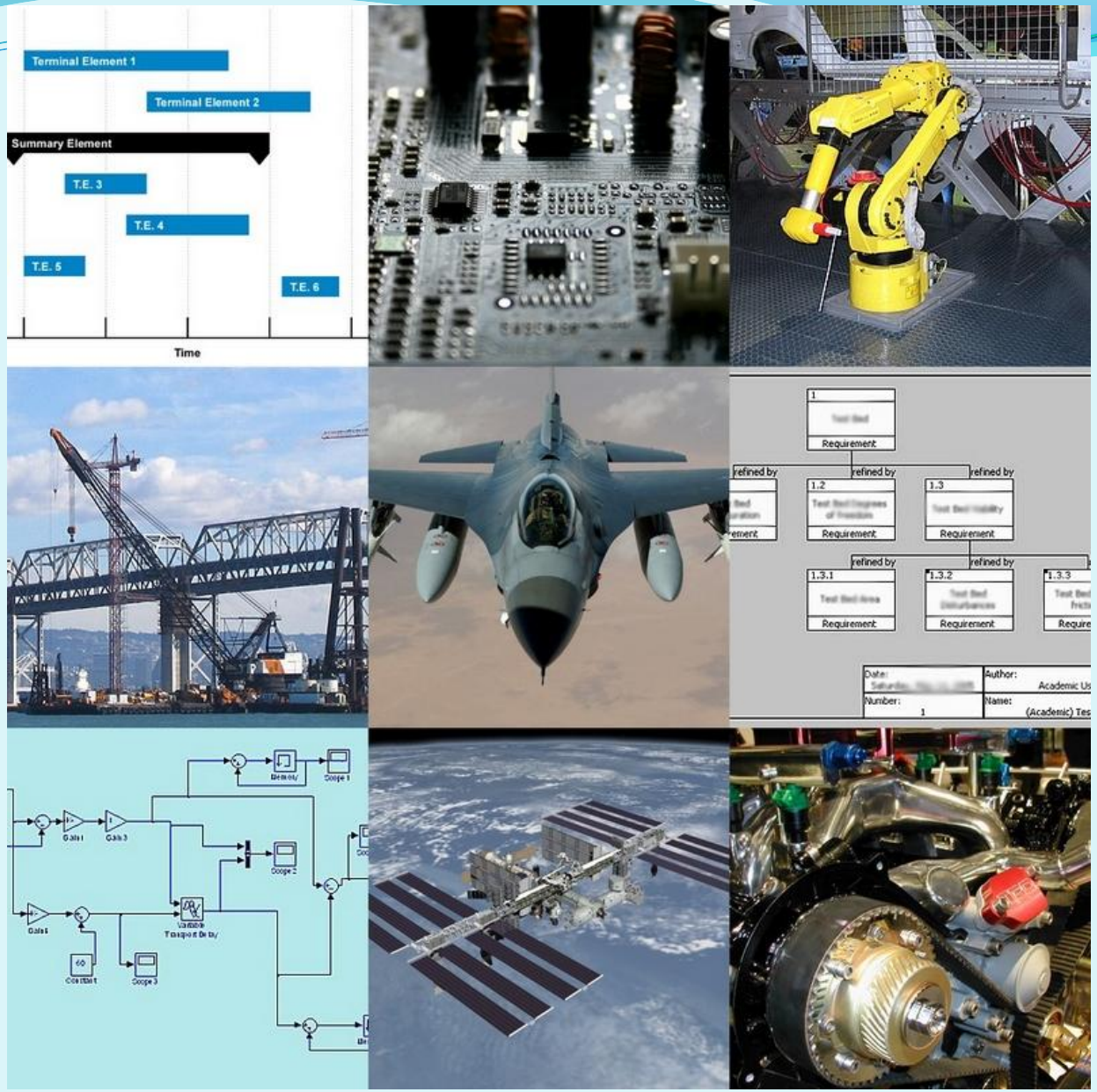
Preview

- This sequence is divided into two parts
  - Engineering Definition
  - Engineering History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Engineers

- Engineers are problem solvers.
- Engineers apply science and technology to develop solutions to practical problems.
- Engineers combine knowledge of science, mathematics, and economics to solve technical problems that confront society.
- Practical knowledge and application distinguishes engineers from scientists.

Origin of the word “Engineer”

- The root of the word “engineer” derives from “engine” and “ingenious”
- Both come from Latin root in “ingenium” meaning to “create”
- The use of the word “engineer” traces back to 200 A.D.
- A person responsible of developing engines of war such as floating bridges and assault towers was called an “engineer” around 1200 A.D.
- During the industrial revolution, the term “engineer” referred to the person that made “engines”

Engineering Defined

- **Engineering** is the discipline, art and profession of acquiring and applying scientific, mathematical, economic, social, and practical knowledge to design and build structures, machines, devices, systems, materials and processes that safely realize a solution to the needs of society. *From Wikipedia*

Engineering Defined

- The Accreditation Board of Engineering and Technology (ABET) provides the following definition:

  - Engineering is the profession in which knowledge of the mathematical and natural science, gained by study, experience, and practice, is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.

History of Engineering

- The concept of engineering has existed since ancient times as humans devised fundamental inventions such as the pulley, lever, and wheel.

- These inventions are consistent with the definition of engineering: using basic mechanical principles to develop useful tools and objects.

History of Engineering

- The history of engineering can be divided into several overlapping eras.
- The distinction among the eras is somewhat fuzzy.
  - It is difficult to specify clear boundaries among the eras.
  - This is due to the fact that engineering is developed in sequence and in parallel.
    - New products are developed from old ones.
  - However, the beginning of an era is usually symbolized by a breakthrough invention.

History of Engineering

- In the context of this work, the ages will be divided into:
  1. Ancient age
  2. Middle age
  3. Renaissance age
  4. Industrial age
  5. Electronics age
  6. Information age

1. Ancient Age
3000 BC – 600 AD

- Ancient engineers and craftsmen worked mainly by trial and error.
- The following is a brief list of their work
  - The wheel
  - Road Systems (Rome)
  - The Hanging Gardens (Babylon)
  - The pyramids (Egypt)
  - The Great Wall (China)
  - Paper and use block printing (China)
  - Military machines such as the Ballista and Catapult

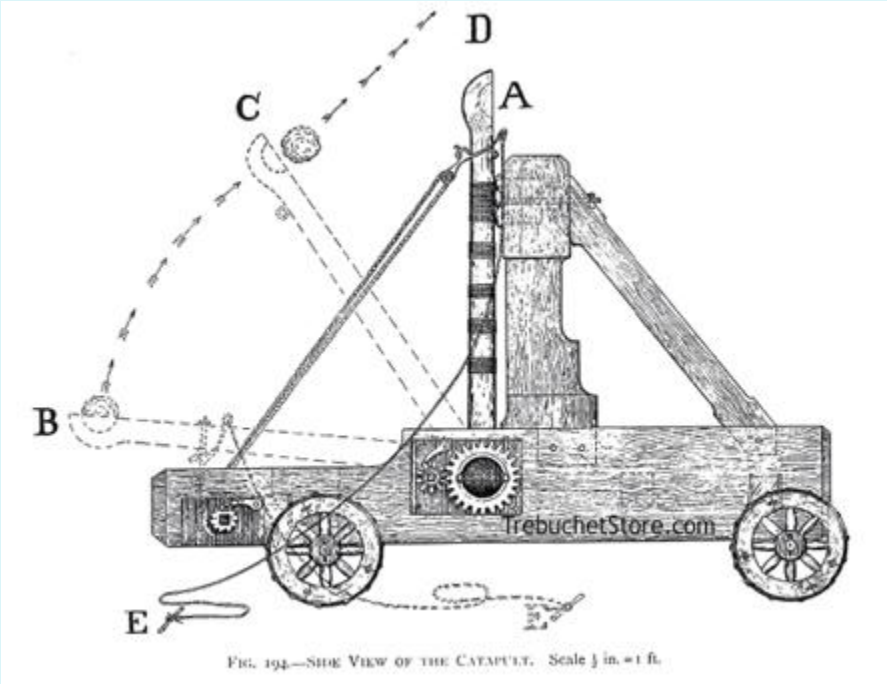

Fig. 194.—Side View of the Catapult. Scale ½ in. = 1 ft.

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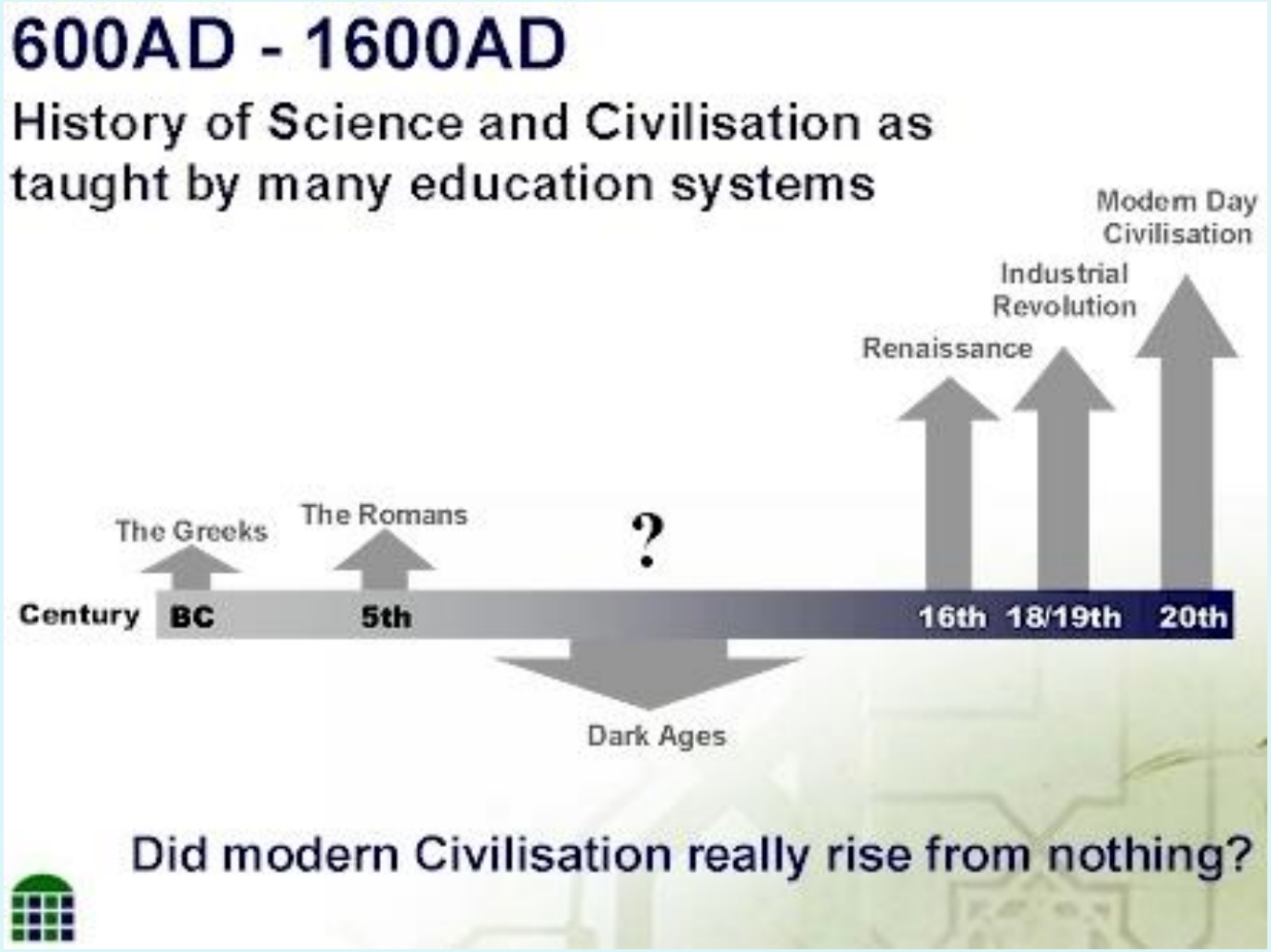
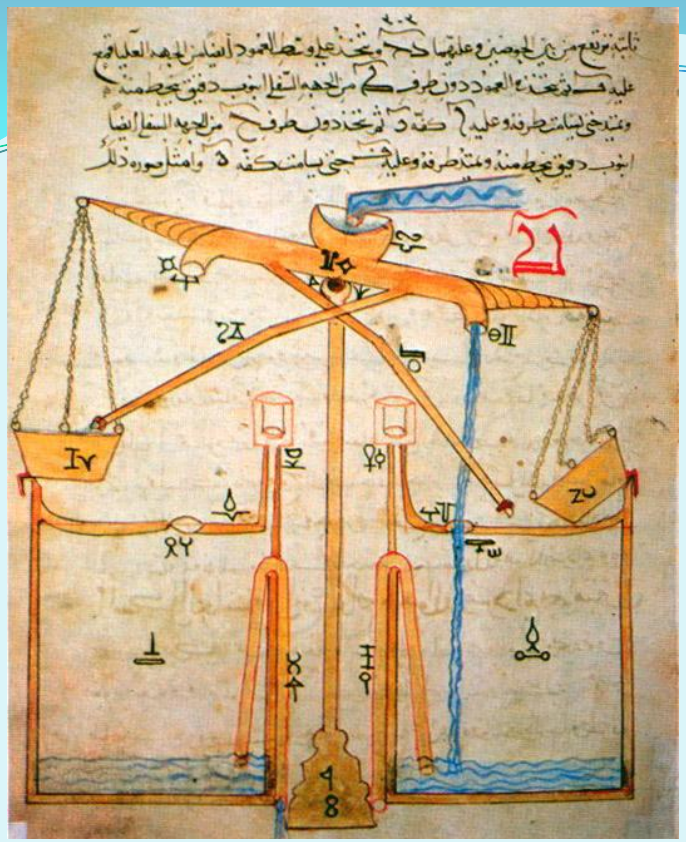
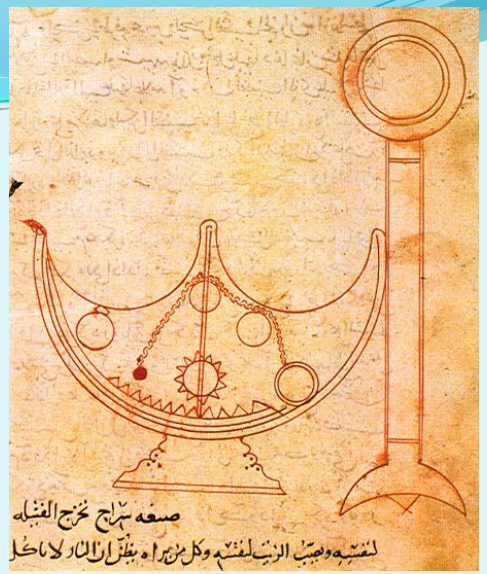


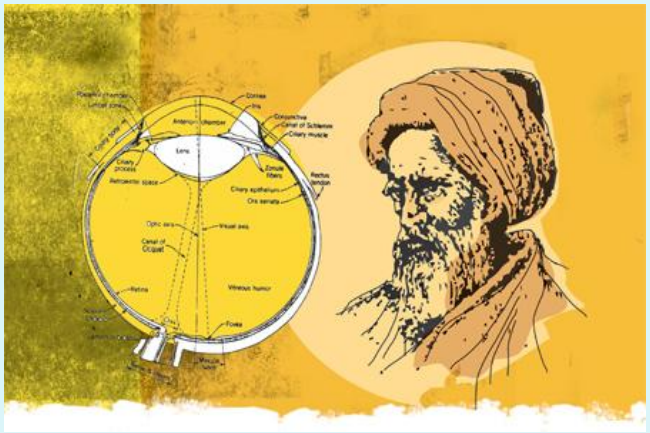
Source: MuslimHeritage.com

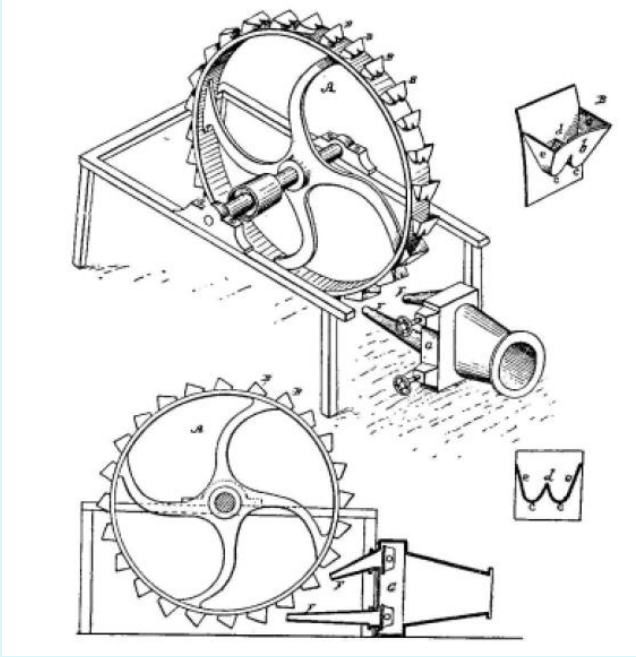
2. Middle Age 600-1600

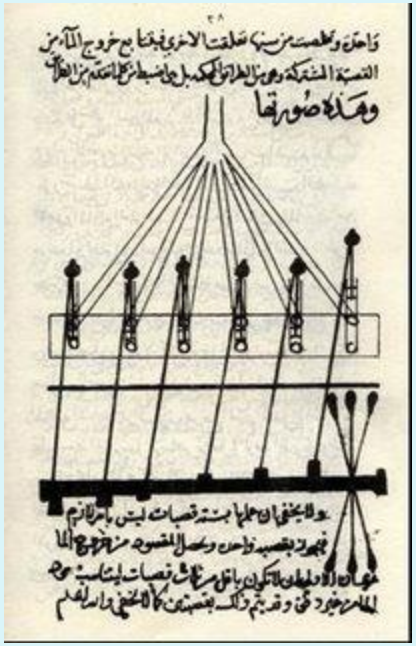
- Significant contribution to mechanics and control.
  - Cylinders and Pumps (Taqi Al-Din)
  - Castle Clock (Al-Jazari)
  - Crank-connecting rod system for water-raising machines
  - Mechanics and Control (Banu Musa)
- Wind Power
- Water Management and Hydraulic Technology
- Dam Construction
- Chemical and Optical sciences











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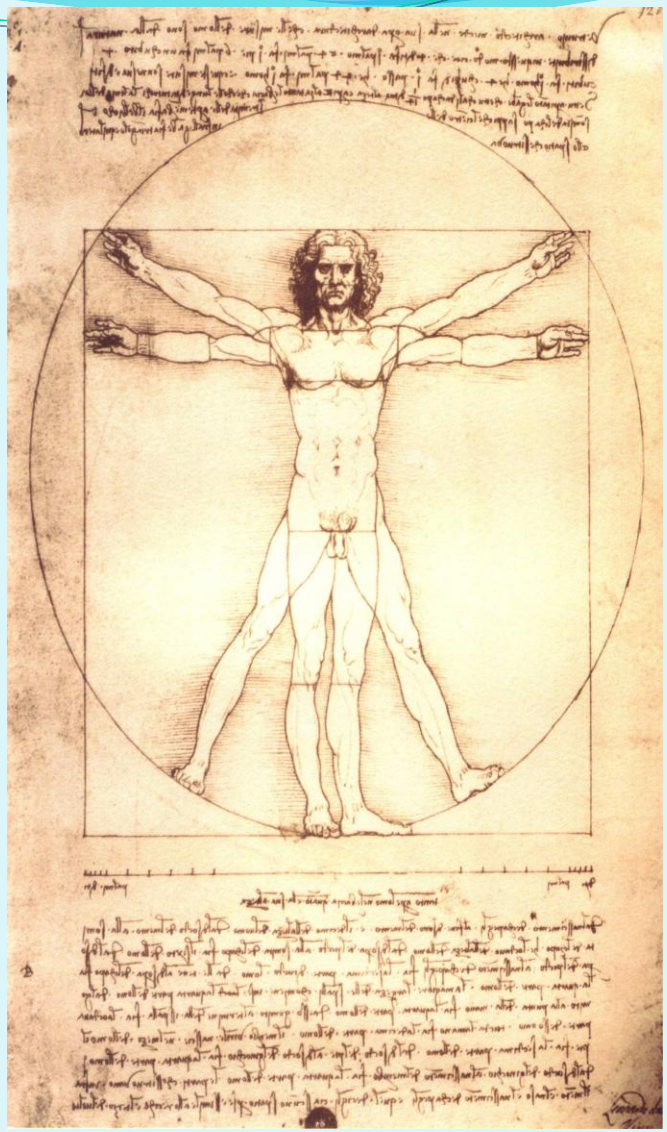
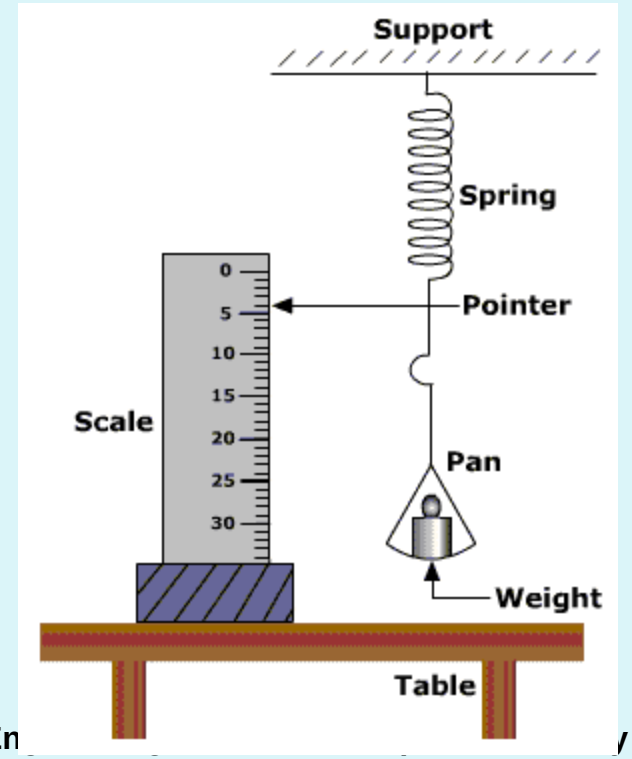
3. Renaissance Age
1600 - 1700

- Many basic engineering and scientific principles and laws were formulated.
- Innovative engineering-like drawings (Da Vinci)
- Earth orbits the sun (Galileo)
- Principia and three laws of motion (Newton)
- Barometer (Pascal)
- Material Strength (Hooke)
- Watch springs and pendulum clocks (Huygens)




Support
Spring
Pointer
Scale
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5
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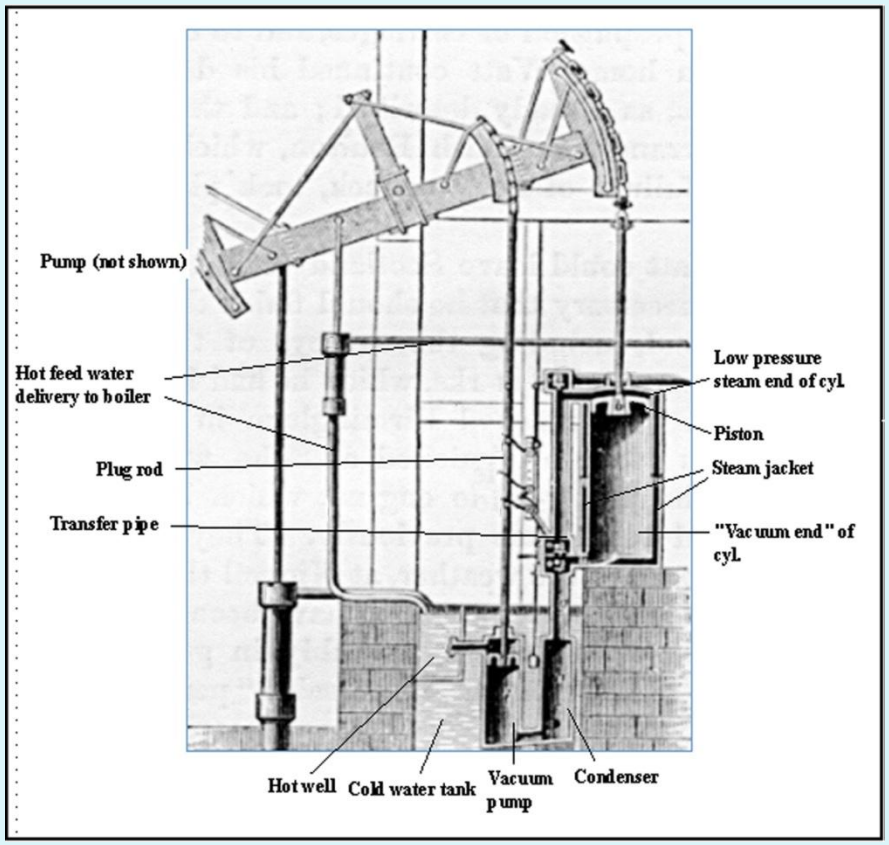
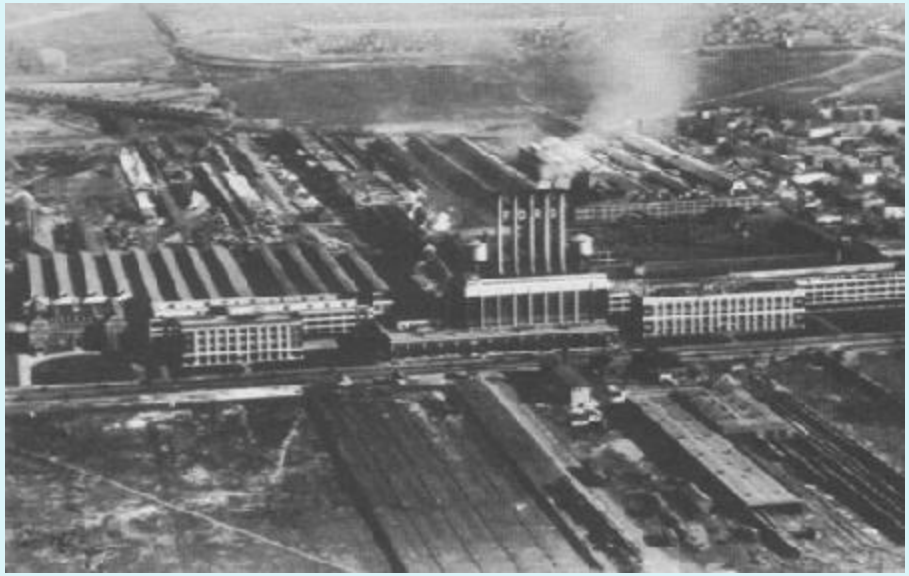
15
20
25
30
Pan
Weight
Table

4. Industrial Age 1700-1945

- Industrial Revolution
  - Power run-factories, railroads, and mass production
- Steam engine (Watt and Savery)
- Electric Battery (Volta)
- Electromagnetics and induction (Faraday / Maxwell)
- Telephone (Bell)
- Electric light (Edison)
- Radio (Macroni)
- Automobiles mass production (Daimler and Ford)
- Airplane (Zeppelin and Wright)





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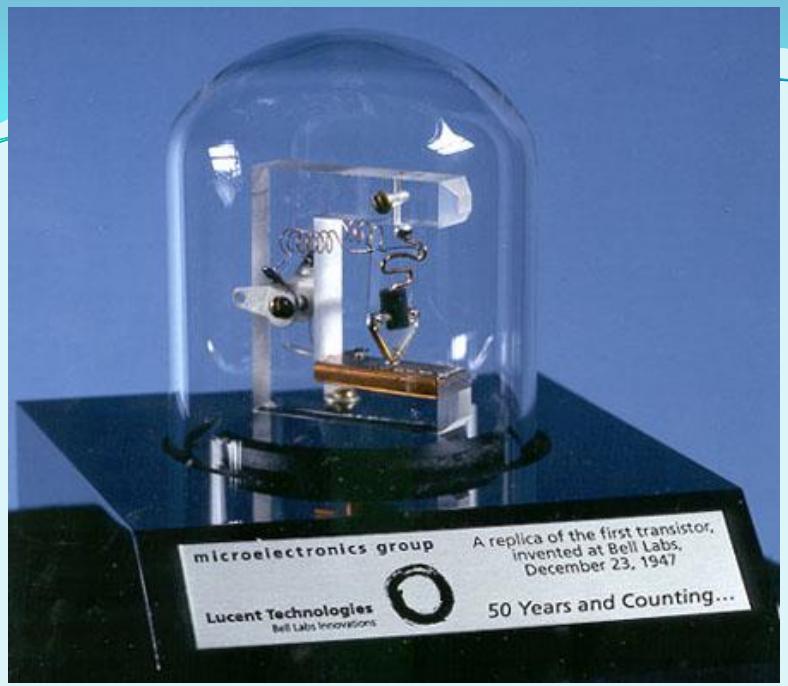
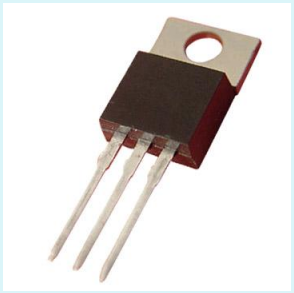
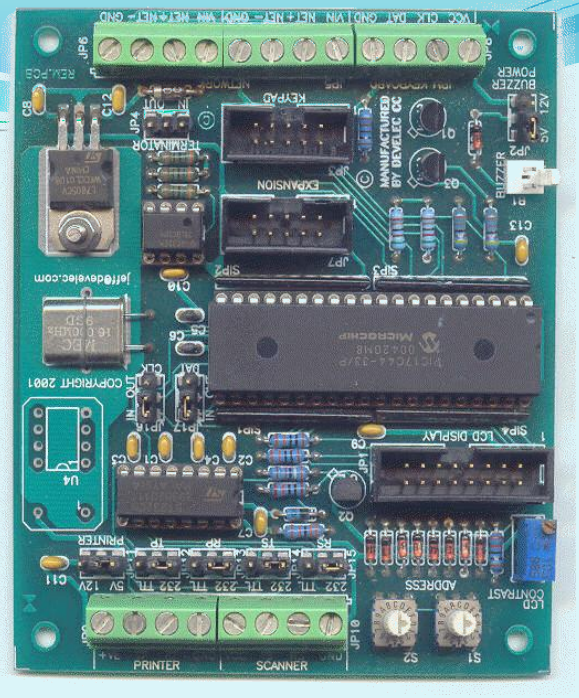
5. Electronics Age 1945-1990

- Research and development boomed after World War II
- Transistor (Shockley)
- First large digital computer (Aiken)
- First nuclear reactor (Fermi)
- Television
- Aeronautic engineers turned the ancient dream of flight into a travel convenience for ordinary people.
- Control engineers accelerated the pace of automation


microelectronics group
A replica of the first transistor, invented at Bell Labs, December 23, 1947
Lucent Technologies
Bell Labs Innovations
50 Years and Counting...

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Scandinavian
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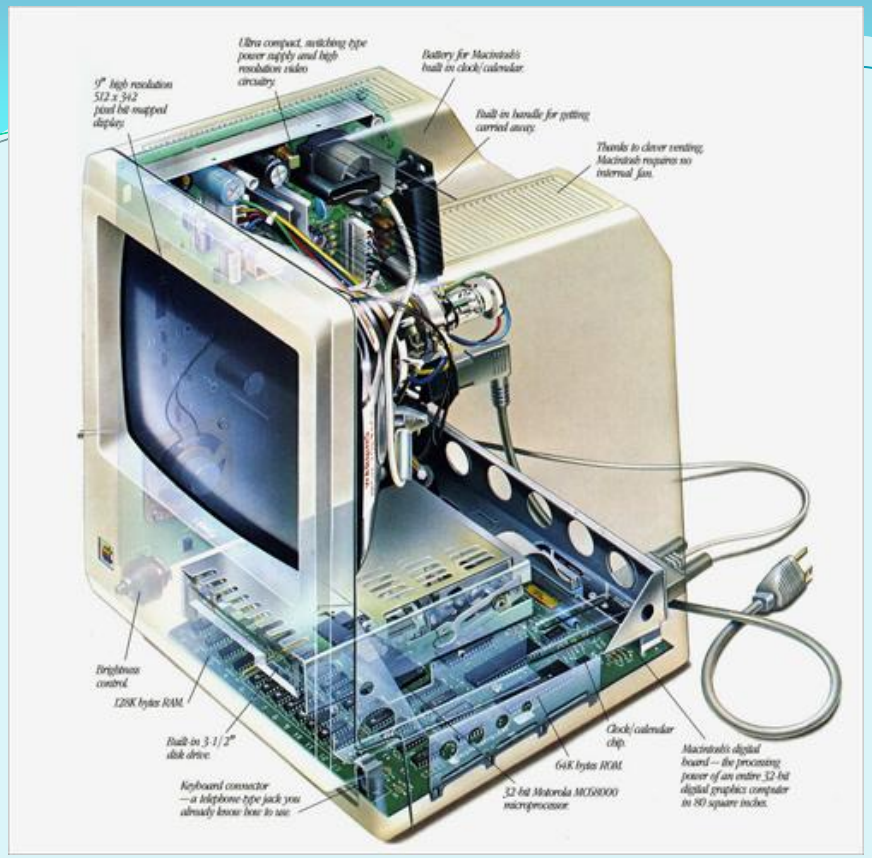
6. Information Age
1990 - Present

- The rise of the computer technology
- Personal Computers
- Internet
- Cell phones
- Bio-technology
- Turbojet and rocket engines
- Atomic and nuclear power utilization
- Advanced materials
- Biotechnology


Ultra compact, switching type power supply and high resolution video circuitry
Battery for Macintosh's built-in clock/calendar
9" high resolution 512 x 342 pixel bit mapped display
Built-in handle for getting carried away
Thanks to clever venting, Macintosh requires no internal fan
Brightness control
128K bytes RAM
Built-in 3-1/2" disk drive
Keyboard connector —a telephone-type jack you already know how to use
64K bytes ROM
32-bit Motorola MC68000 microprocessor
Clock/calendar chip
Macintosh's digital board — the processing power of an entire 32-bit digital graphics computer in 80 square inches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Appointment with C. Scott
4:00PM-5:00PM
Contacts
Messaging
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Conclusions

- Engineering is the profession in which mathematics and science is applied to develop systems, products, and processes to benefit society.

- Engineering history can be divided into six stages:
  - Ancient, Middle, Renaissance, Industrial, Electronics, and Information.