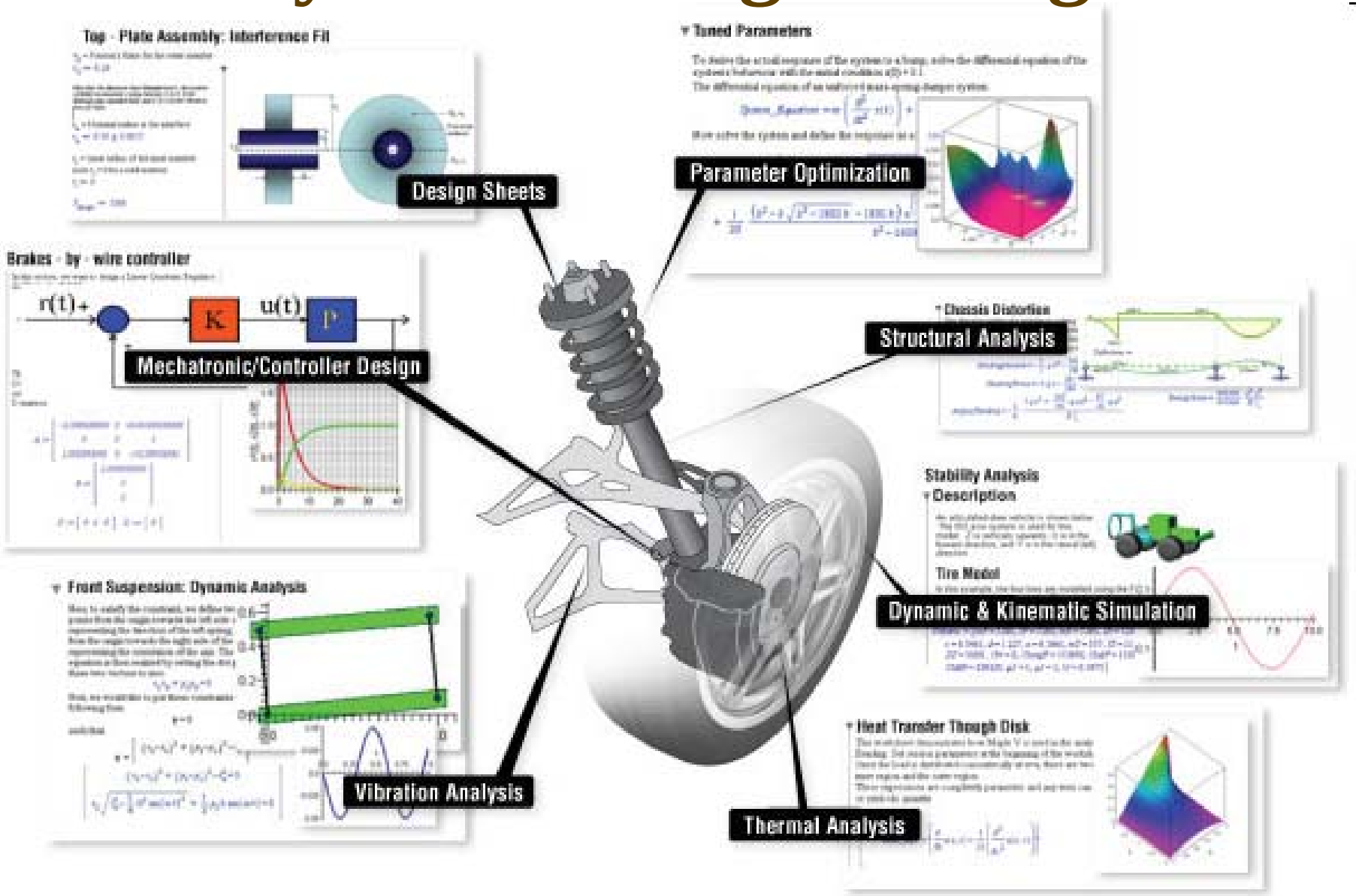
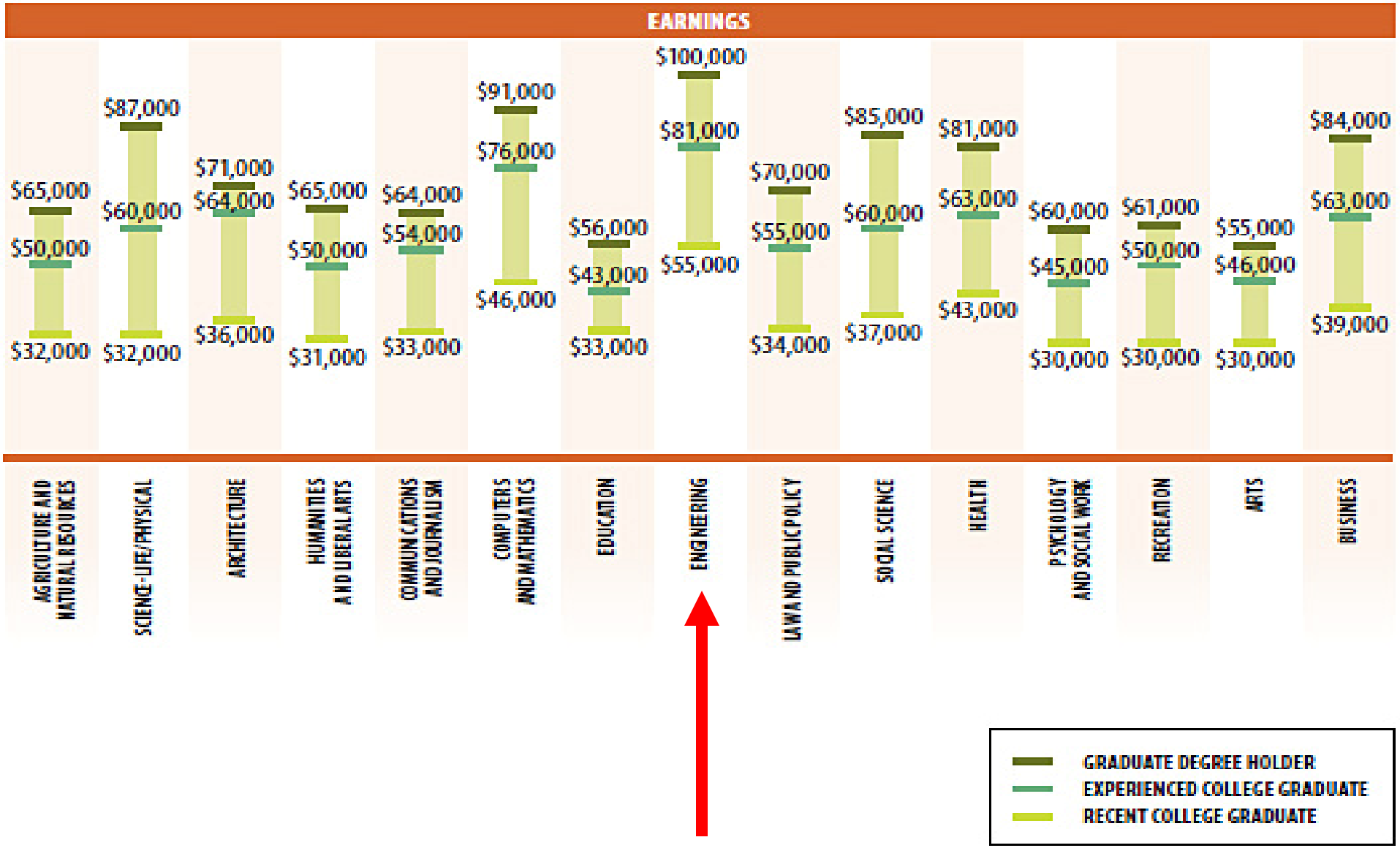
Why choose Engineering?



You think it's tough.

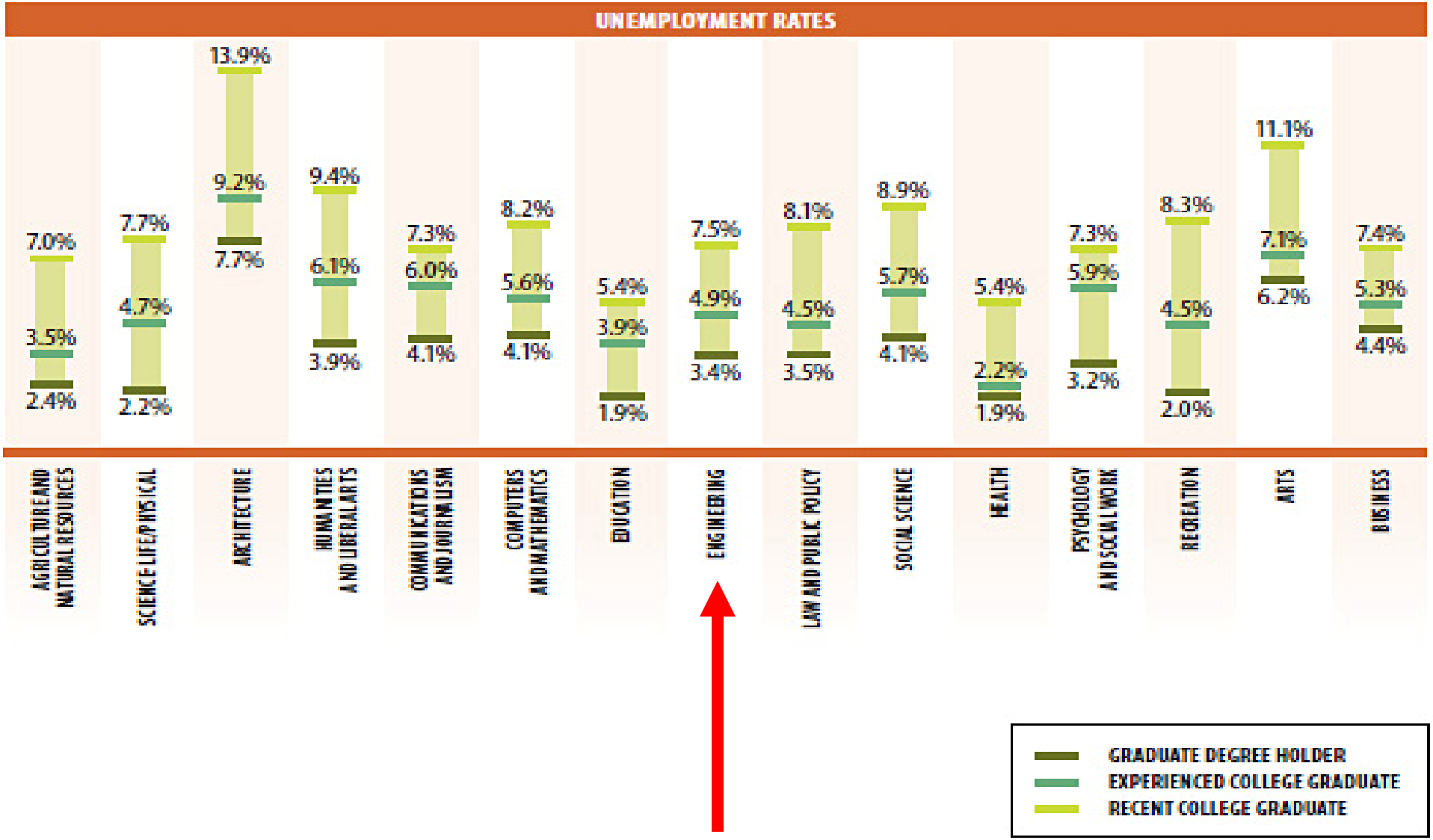
Consider the rewards



Better Opportunities.

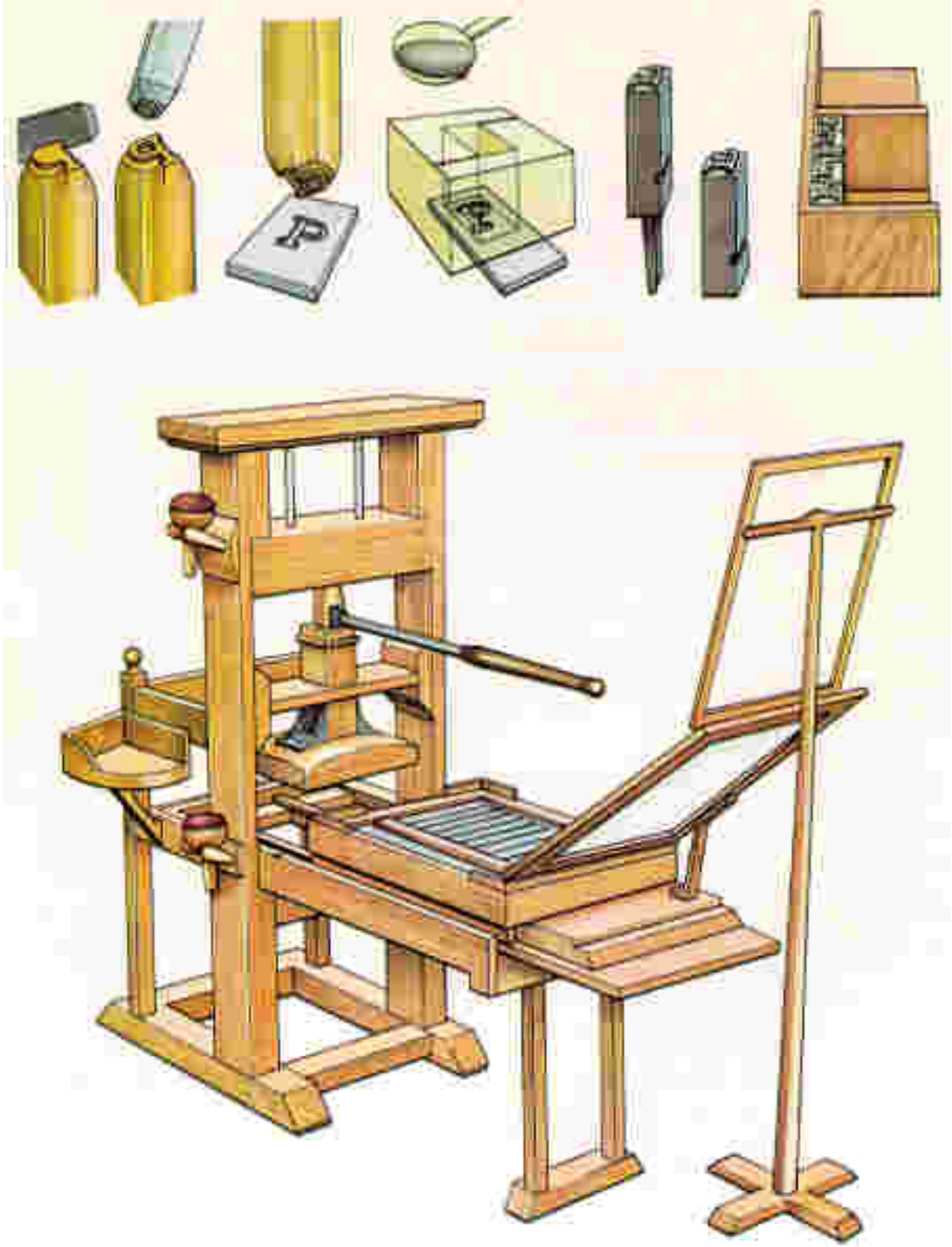
UNEMPLOYMENT RATES DECREASE AS
RECENT COLLEGE GRADUATES GAIN EXPERIENCE AND GRADUATE EDUCATION

Better Pay

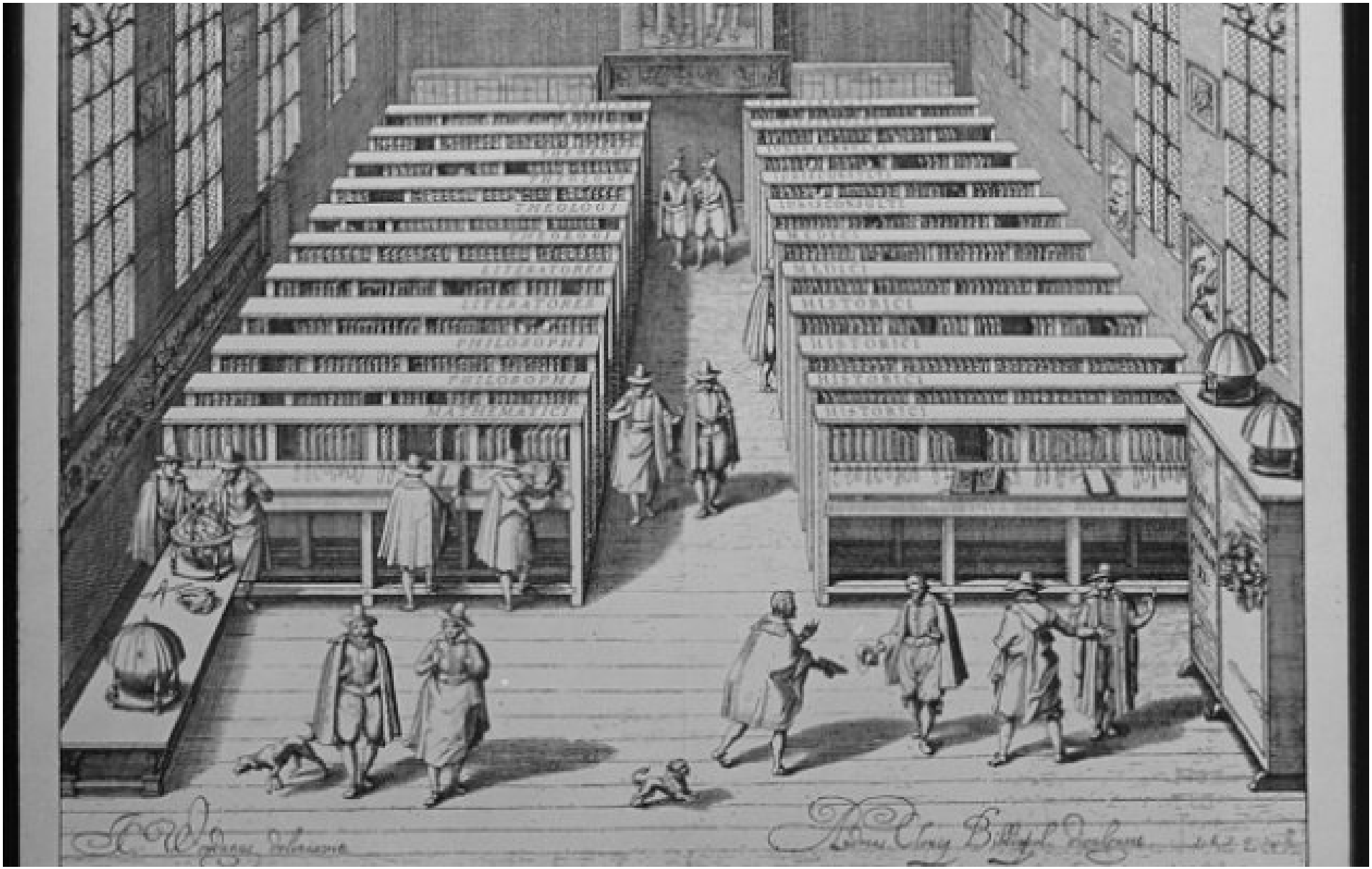


Science and Engineering
History – The first Universities

Gutenberg Printing Press ~1450



University Library in Leiden, ~1610

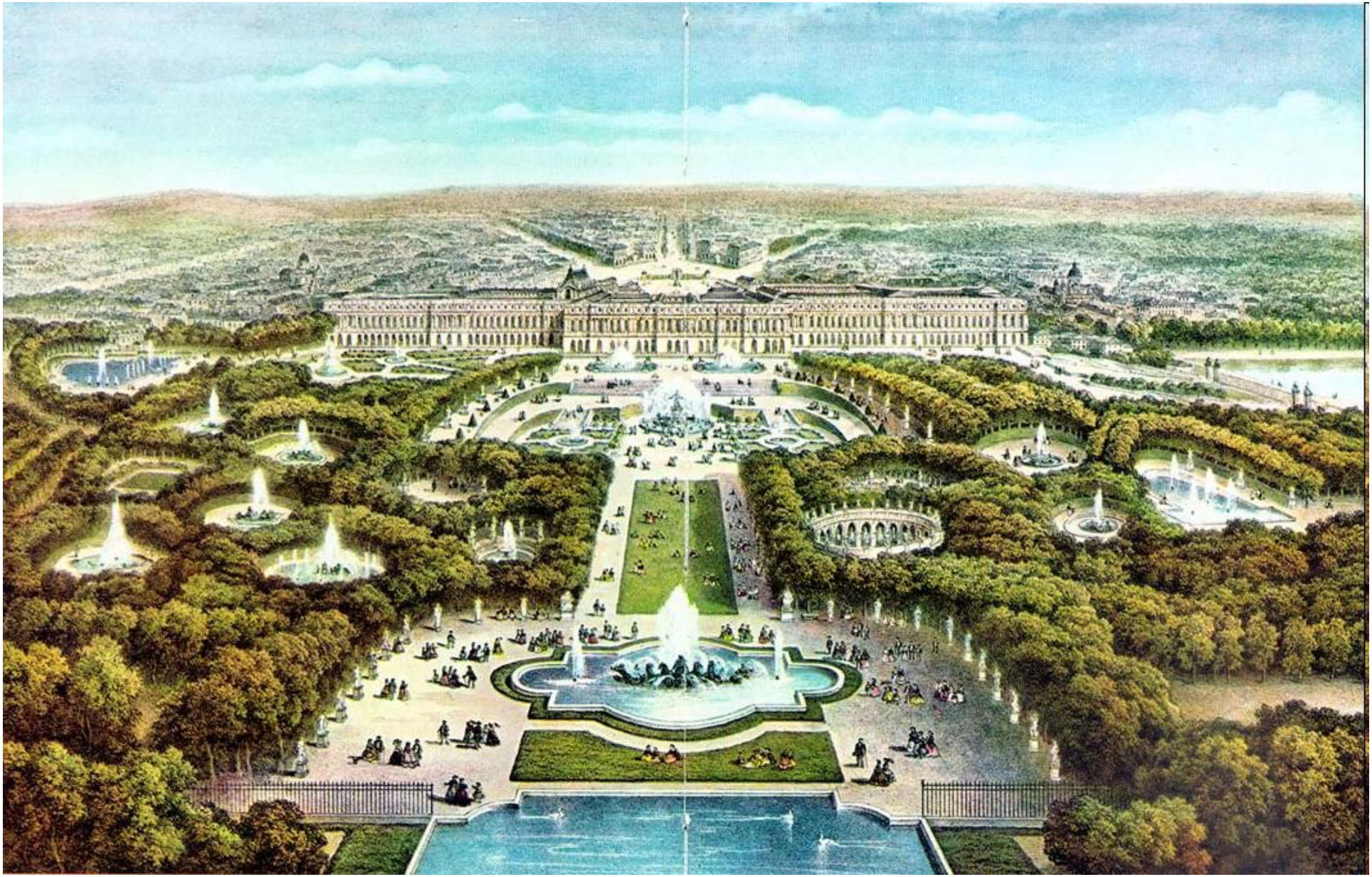


Look how far we have come:

Treadmill in Leiden, Netherlands 17th Century

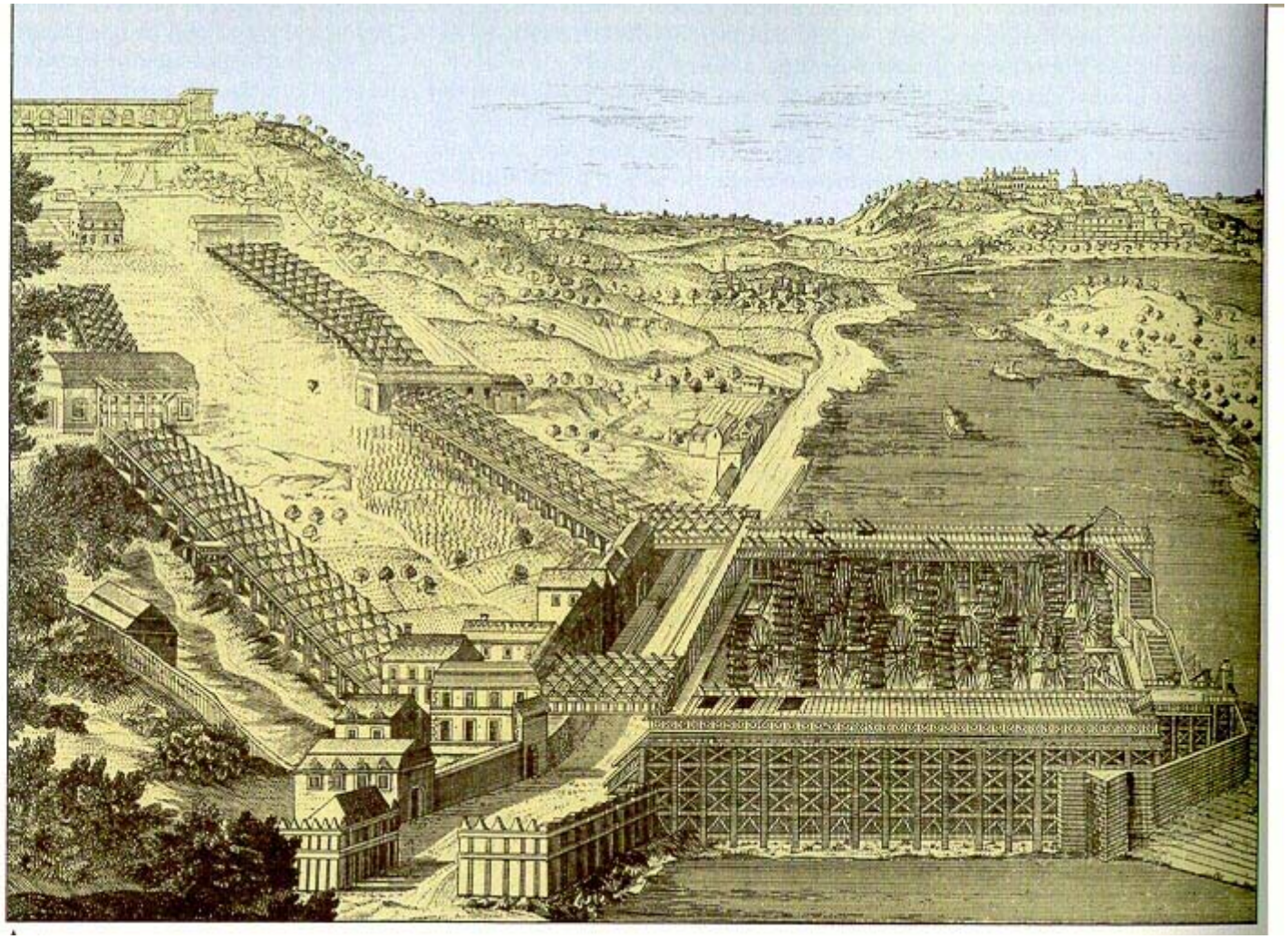
Louis XIV
Roi de France
1638-1715

Louis XIV in Majesty, 1701 , by H. Rigaud



Le Chateau de Versailles

Thirteen water-wheels powered 235 force pumps, which pumped up to 1 million gallons (5,000 m^3) of river water into the reservoirs daily. The reservoirs were situated 525 ft (160 m) above the river.



Versailles: The King's Waterworks (supplying his fountains)

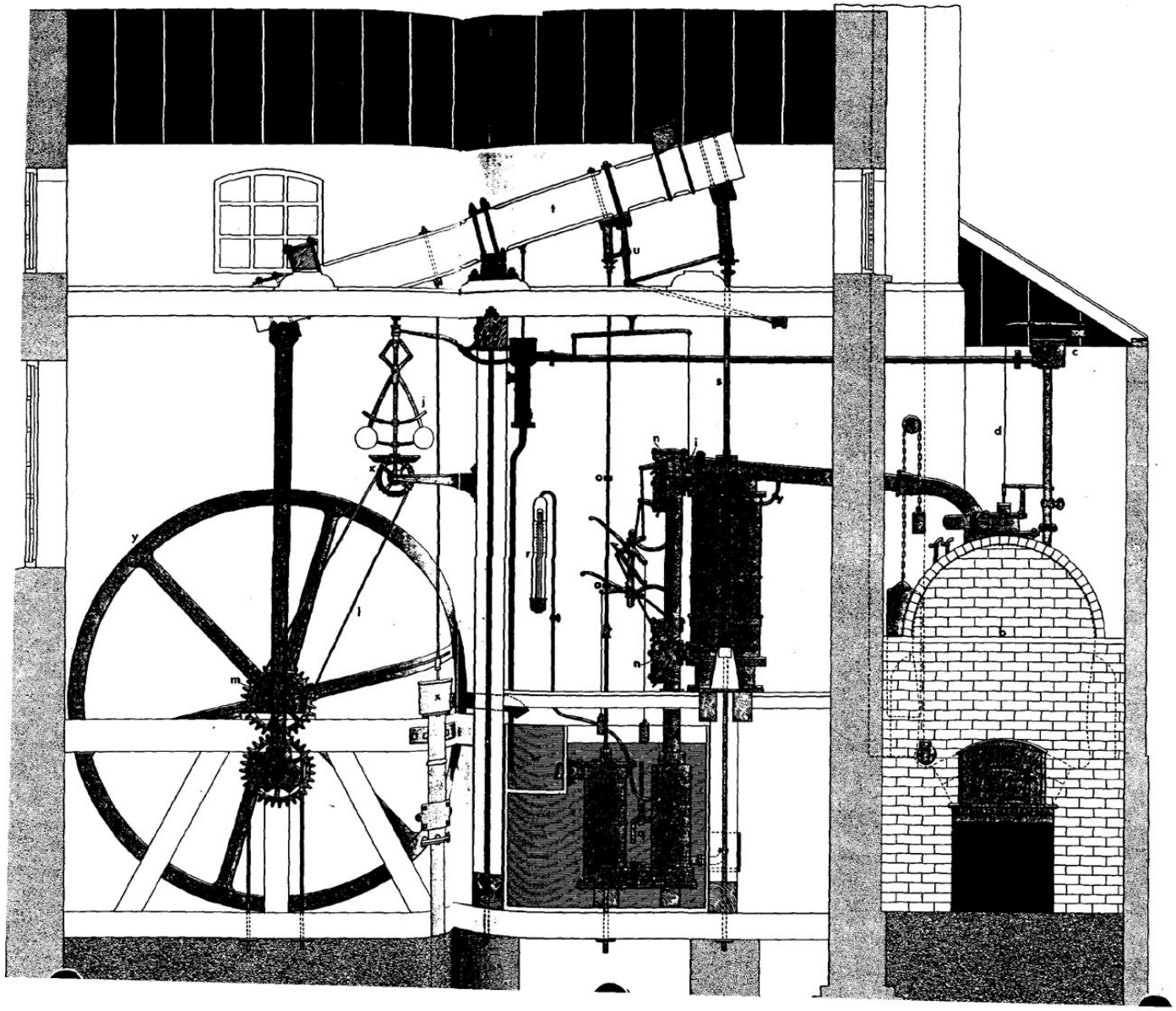
Total Output: approx. 50 hp

Isaac Newton

Scientific Inquiry takes time and effort. Newton's law:

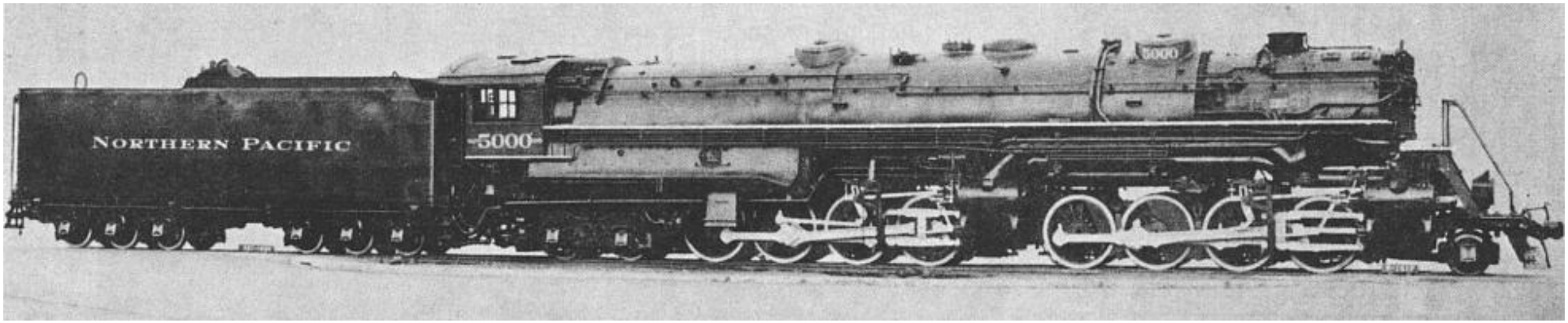
F = m*a

- From Galileo's fall experiments in Pisa, it took 100 years until Newton finally formulated it.
- Science is analytical and systematic, but generally NOT intuitive



Between the years 1
quite a large number
acting steam-engines
were manufactured
& Watt workshops. T
fect was 10 horsepow
worked with twenty-
strokes a minute. (*a*)
(*b*) Boiler. (*c*) A devi
which the water leve
was controlled. At th
a string (*d*), a float w
When the float sank
the boiler, a valve (*e*
and water, hoisted b
pump (f), poured in.
had returned to its c
valve was closed ag
the boiler was admit
pipe (*g*) to the cylind
a throttle valve (*i*), t
aperture was detern
trifugal governor (j).
gear train (*k*) and a
governor was powe
(*m*) *of the sun-and-p*
cylinder (*h*) was clos
and steam alternate
above and below th
two valve chests (*n*).
valves were opened
projections (*o*) on a
Condenser. (*q*) Pipe
cold water into the
Manometer. The pis
tion was transmitte
(*t*) by a *parallel link*
was also linked to a
means of which cor
and air were pump
(*w*). (*x*) Pump, driv
ance and used to p
water to the cistern
condenser and pun
mersed. The balan
movement was tra
rotary movement b
cog-wheel, *the plar*
meshed with the s
wheel's (*y*) shaft.

Boulton &Watt Steam Engine, ~1800



Northern Pacific class Z-5

The first Yellowstone was built in 1928 by ALCO for the Northern Pacific for running throughout the high speed plains of North Dakota. The Yellowstone was designed with the largest firebox ever.

The Yellowstone was the largest steam locomotive in the world (at that time) and ALCO celebrated by serving dinner to 12 people seated in the firebox! The NP Yellowstones produced 5,000 HP.

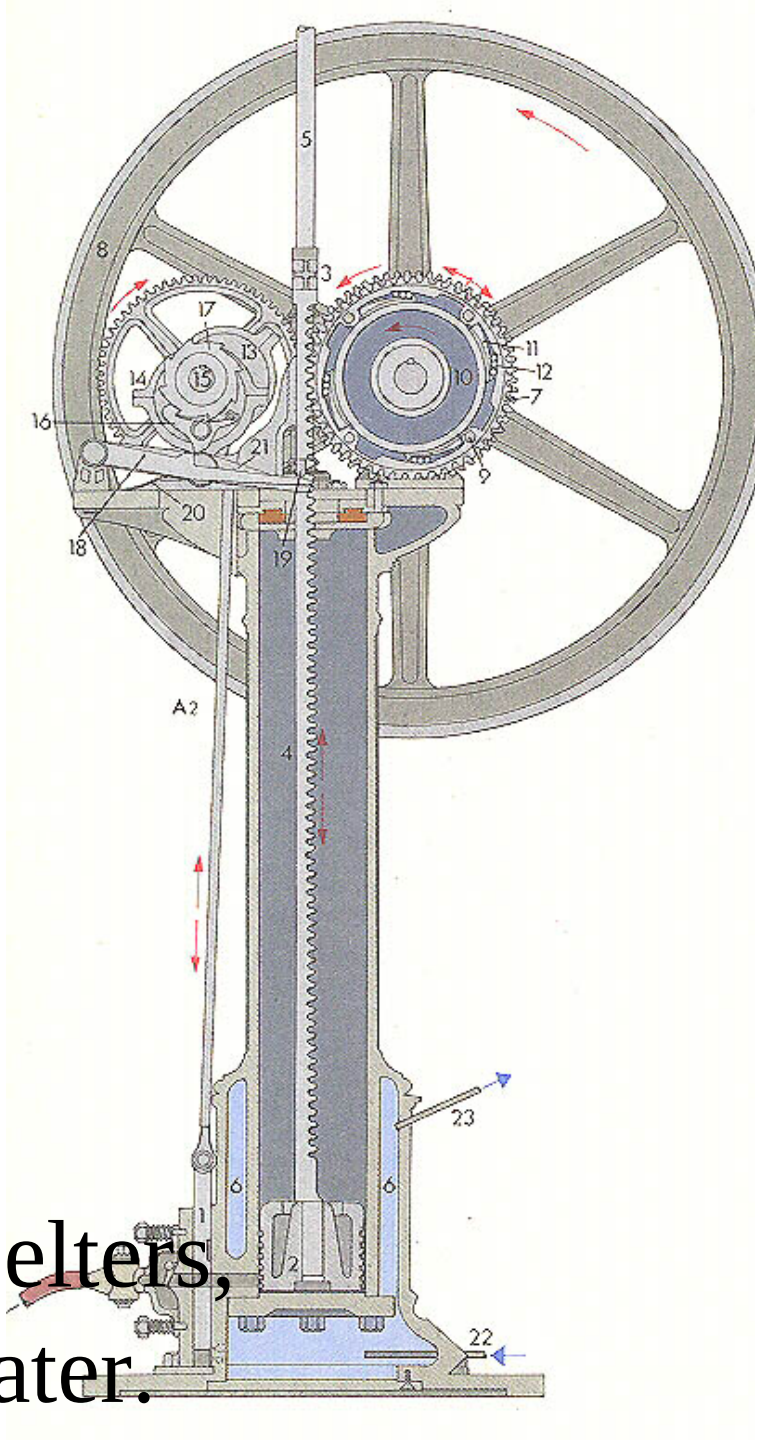
The First IC Engine

Used coal gas,
About 10 m tall,
Free-flying Piston

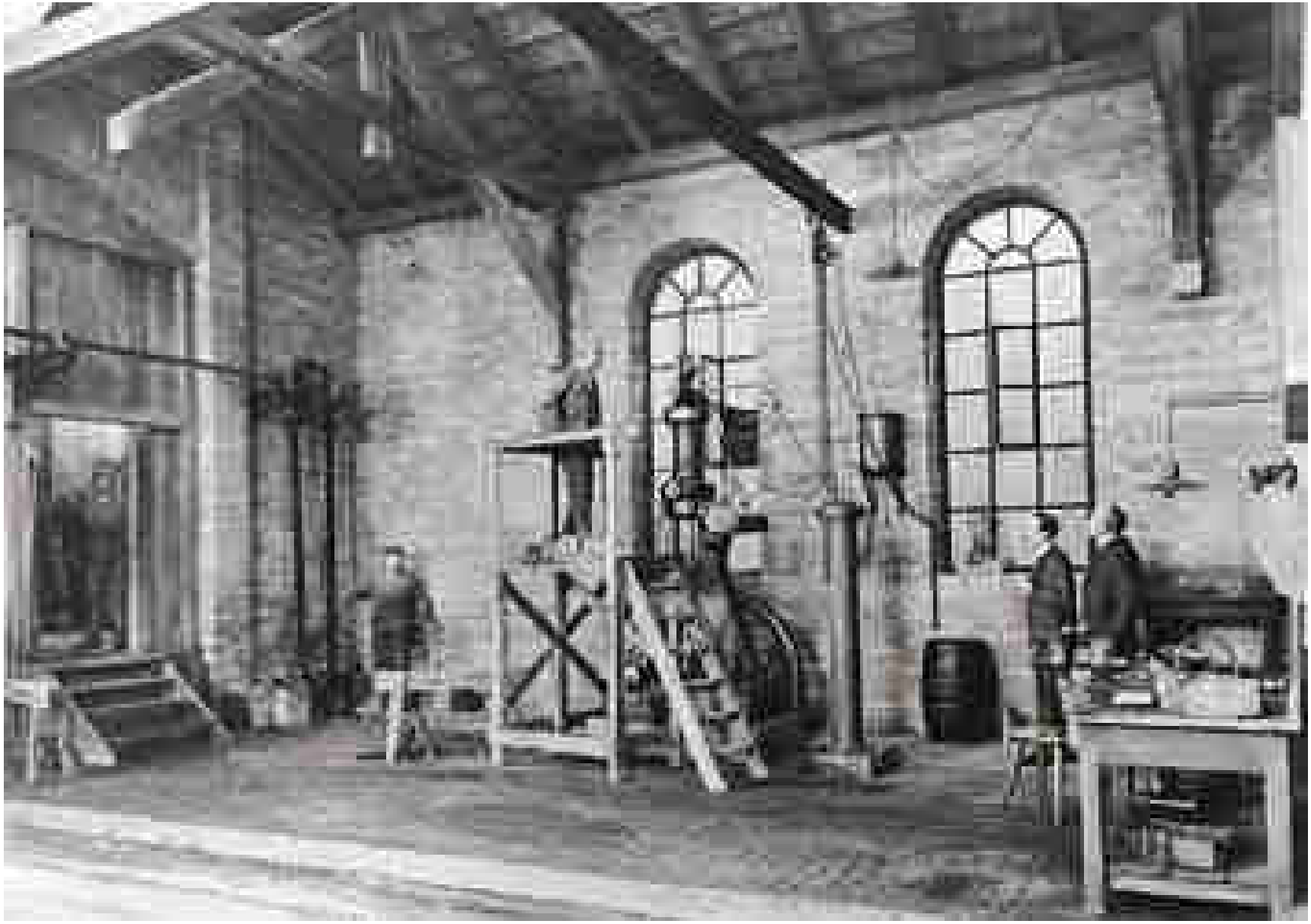
Operation

Step1: The gas/air mixture is compressed as the piston falls under its own weight.

Step 2 : The compressed gas/air mixture is ignited, driving the piston up. (the work stroke)

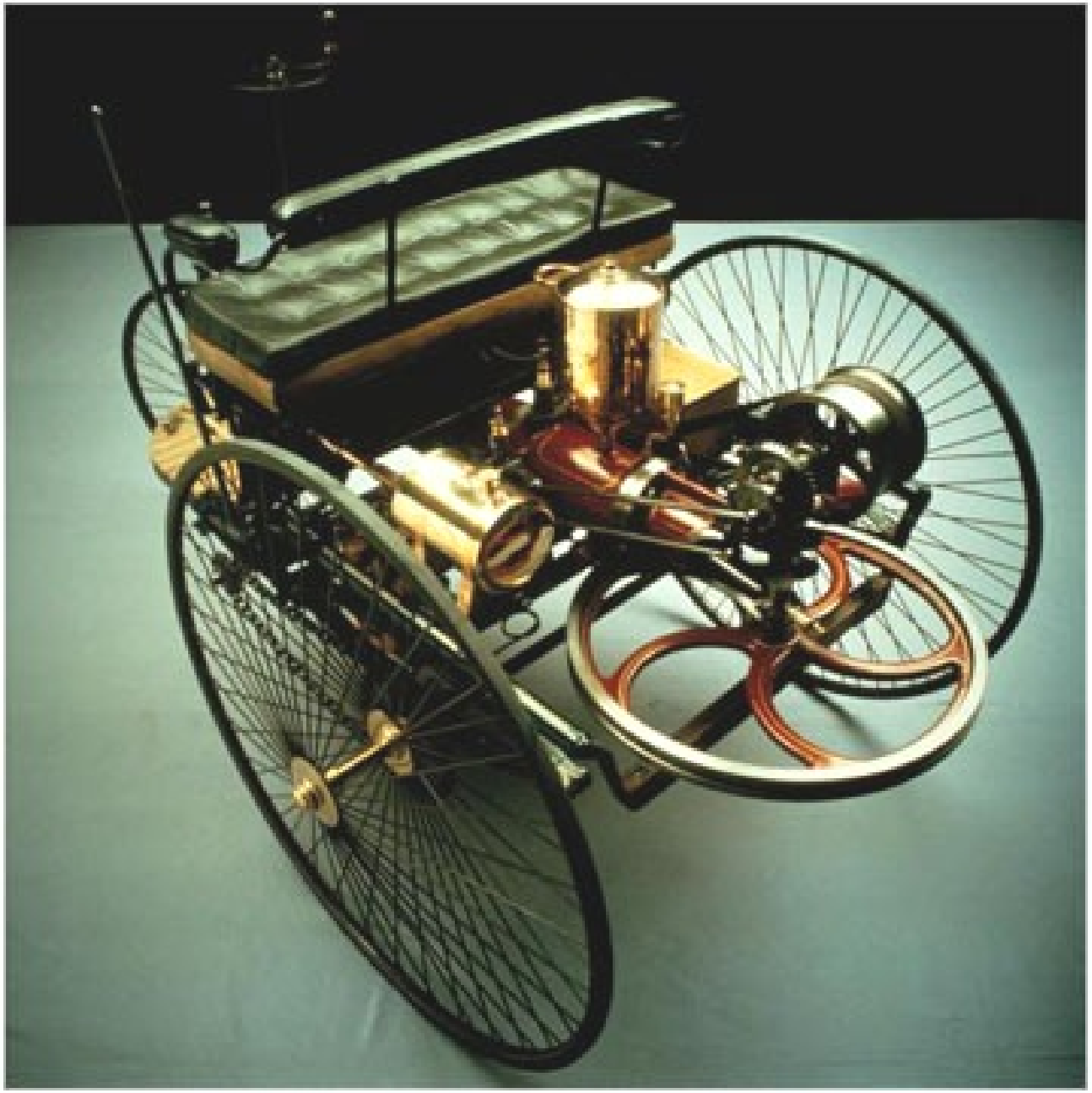


This engine was installed in Selters, Germany, to pump mineral water.



Rudolf Diesel in his Laboratory, 1896

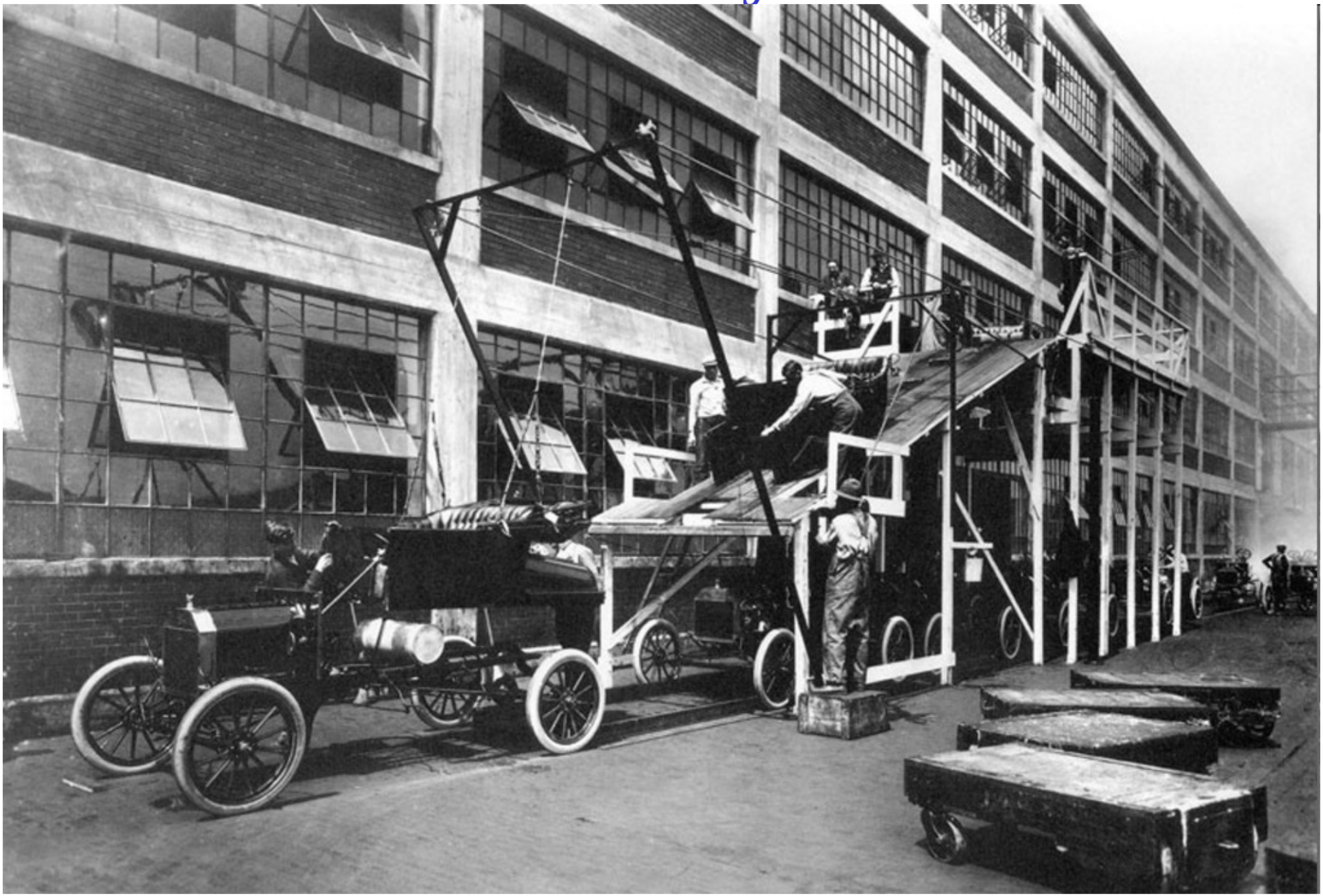
Rudolf Diesel



Carl Benz’s First Motor car, 1886

Mercedes Motor car, 1910

Olds Assembly Line 1913



Model T Ford

Ford’s Assembly Line

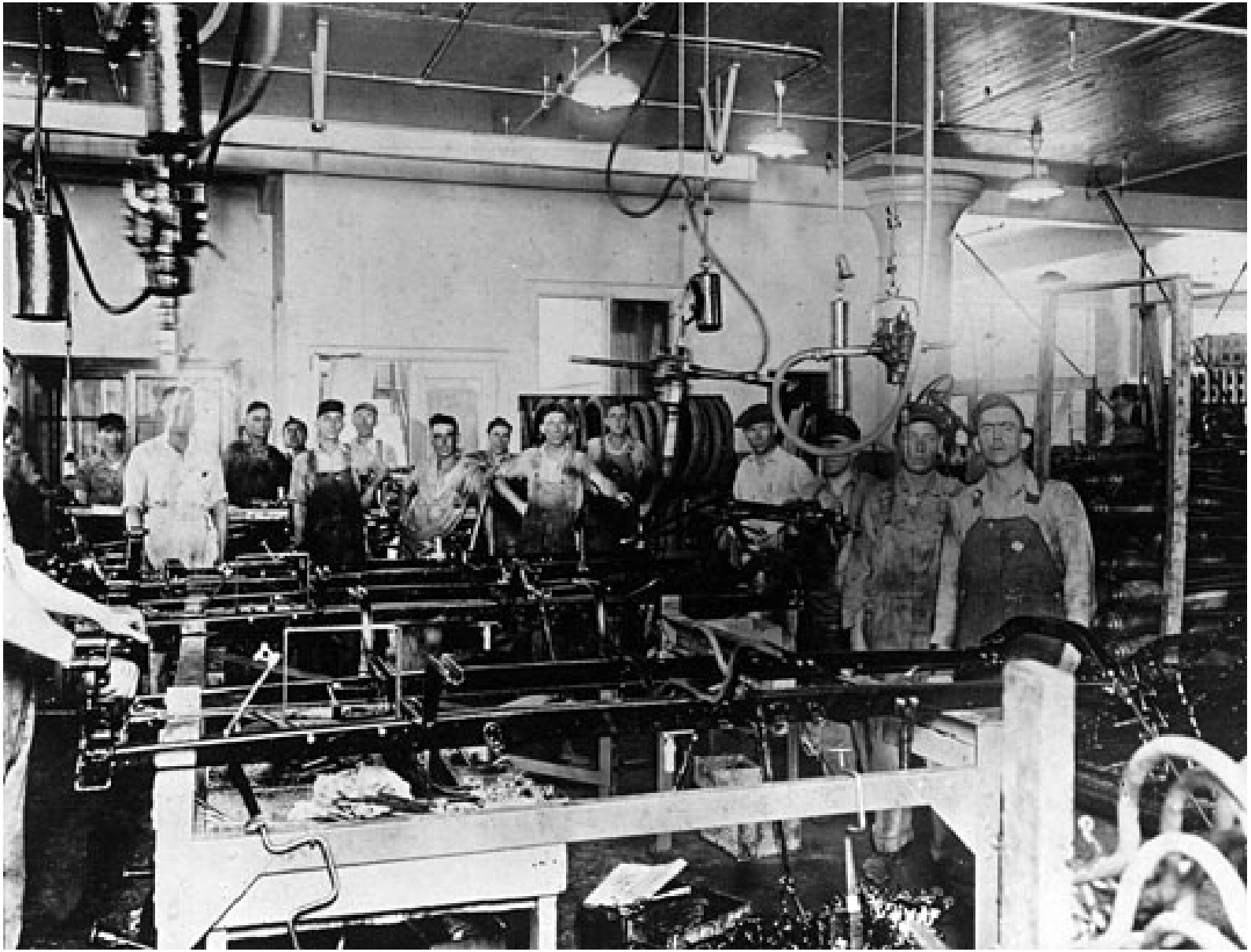
Mass-production techniques changed the way people work and live throughout the world.

The Model T put America on wheels. But the real revolution was the production technique developed in 1913. Ford Motor Co.'s moving assembly line, and the rapid spread of its mass-production methods, profoundly changed the way people work and live world-wide.

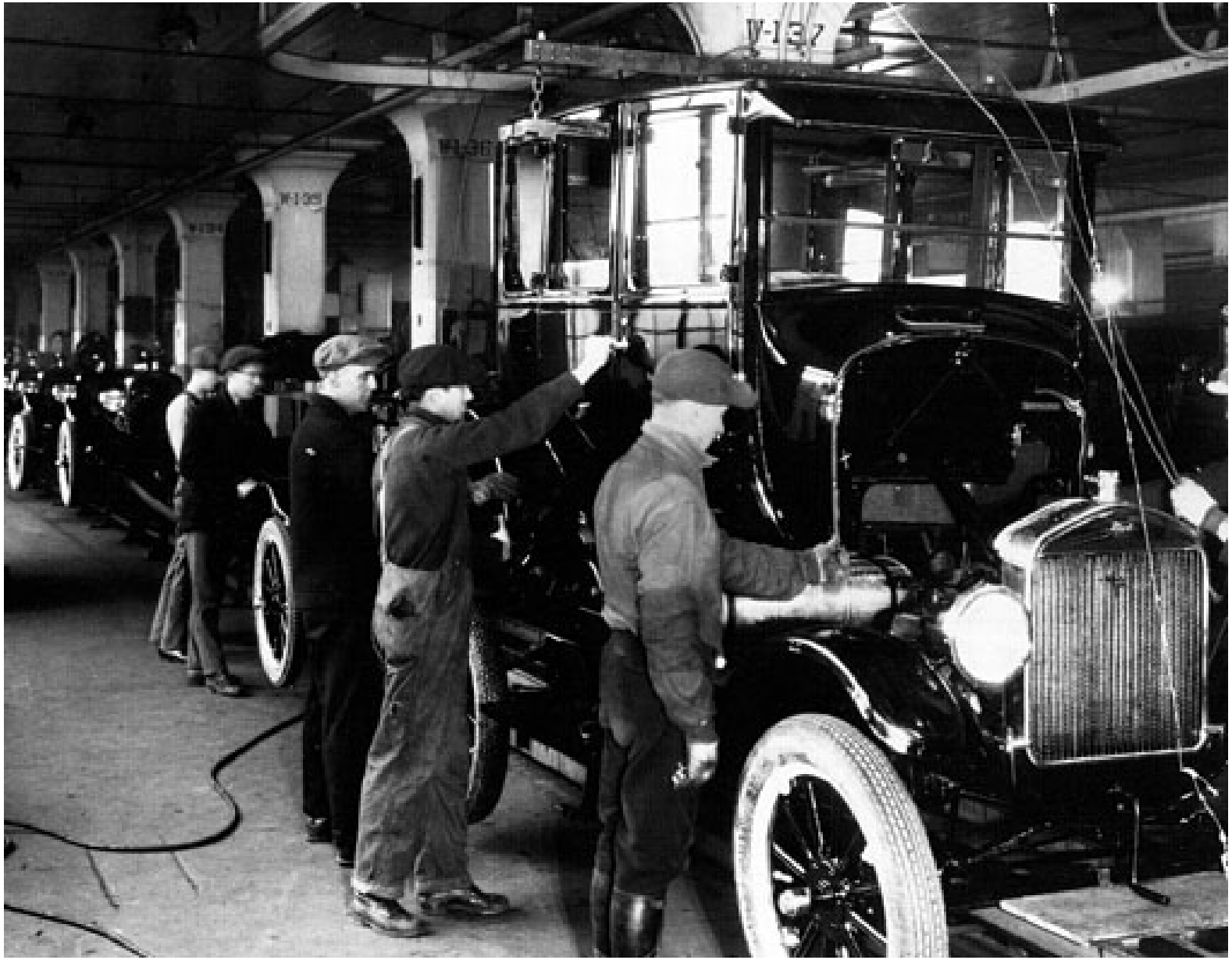
Ford’s Assembly Line II

As William C. Klann, a foreman in Ford's engine-assembly shop, told it, he and his colleagues had visited slaughterhouses and had been impressed with how conveyors carried hogs and cattle through a disassembly process.

Why not use the same idea to speed up an assembly system? Mr. Klann and his colleagues began experimenting with a **conveyor** to speed up the assembly of one component of the Model T engine.



Auto workers at the piston and rod assembly line at the Highland Park Plant, ca. 1918.

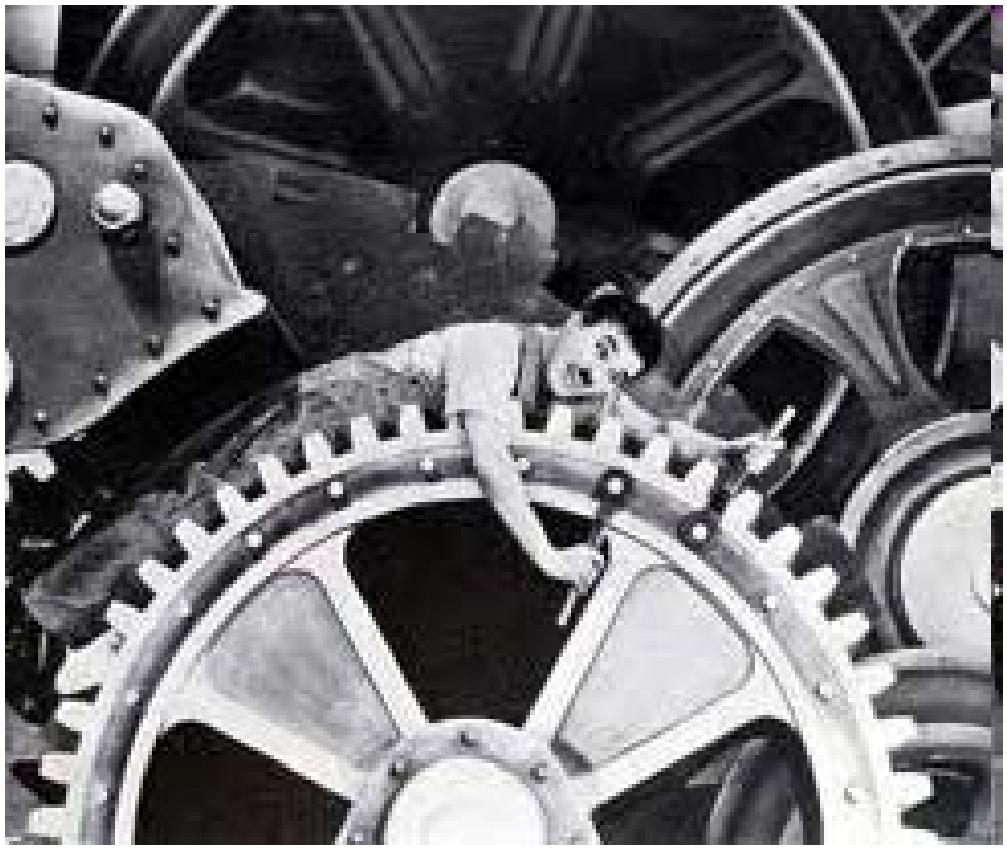


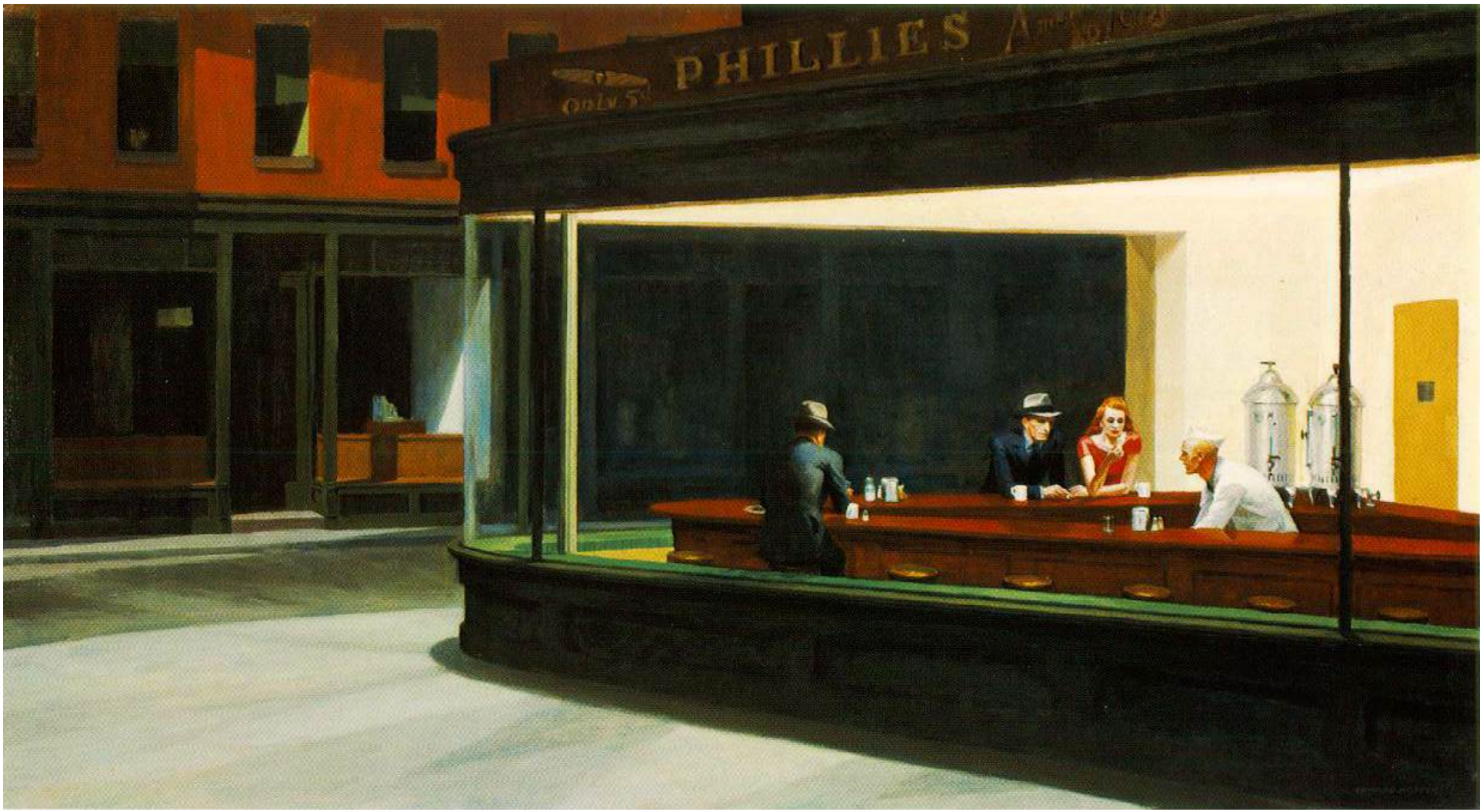
The body drop on the assembly line of the Highland Park Plant.

Mass Production and its division of labor brings *Alienation*

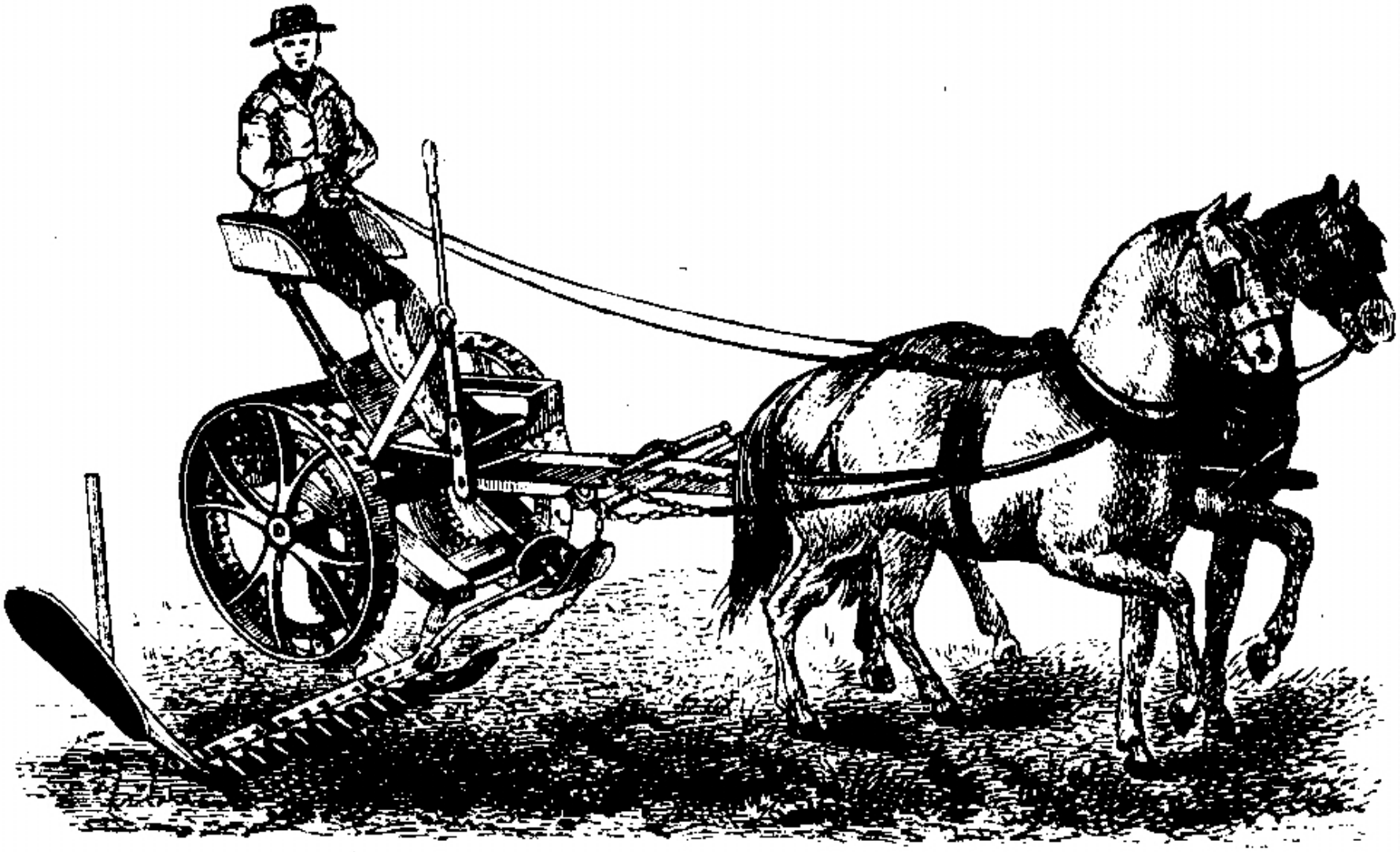
(see also next slide)

See Karl Marx's writings for definitions





Nighthawks
by Edward Hopper



McCormick’s Reaper

Many inventions from the Industrial Revolution period are still used today:

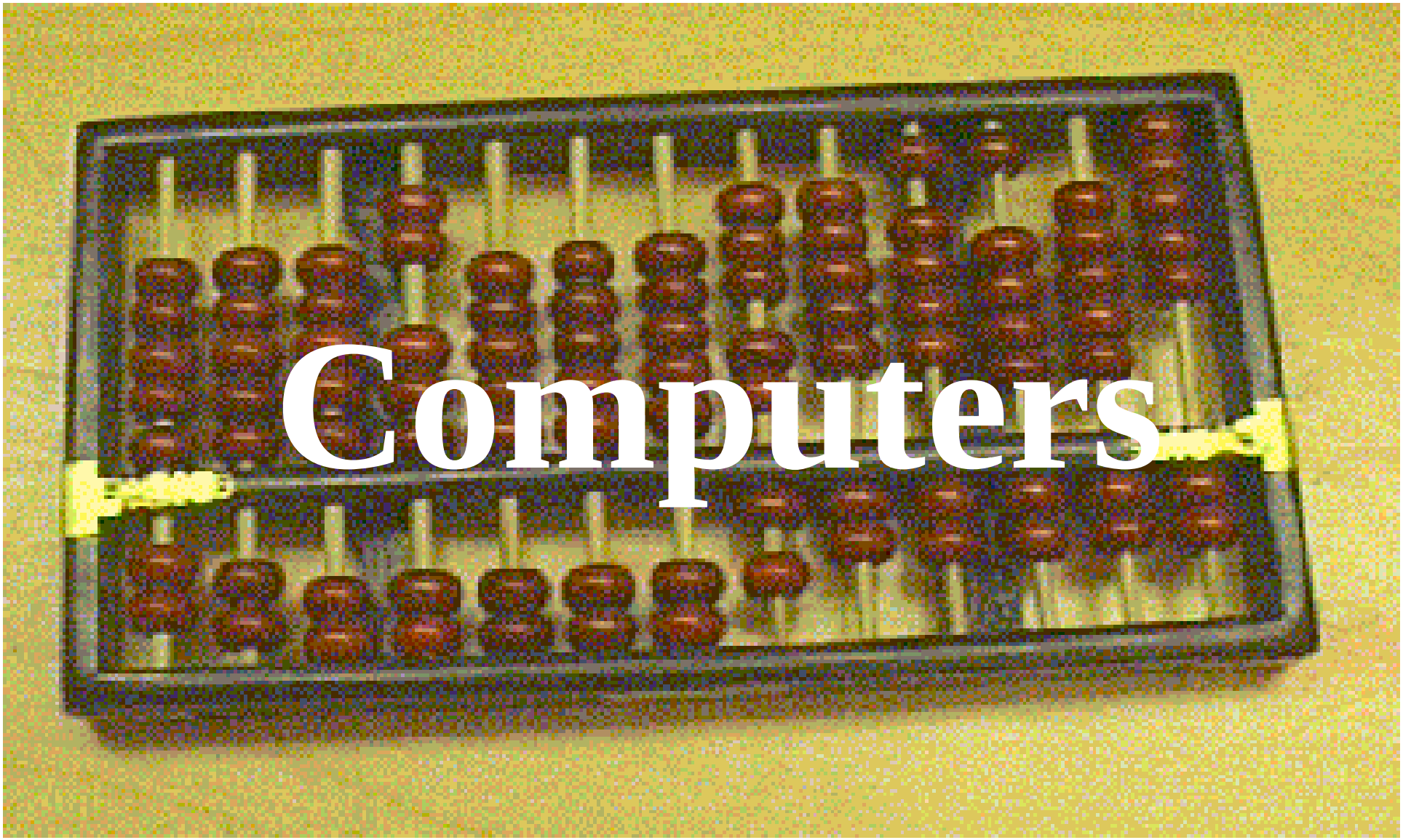
the sewing machine (invented by Elias Howe),

the steel plow (invented by John Deere),

the reaper (invented by Cyrus McCormick),

vulcanized rubber (inv. by Charles Goodyear),

The Industrial Revolution greatly transformed the economies and societies of the U.S. and the other industrial countries.


Computers

A computer automatically performs logical (mathematical) operations on input information and puts out answers, according to a predetermined ´ program ´ of instructions.

Herman Hollerith's Punchcard Machines

Hollerith won the competition for the delivery of data processing equipment to assist in the processing of the data from the 1890 US Census

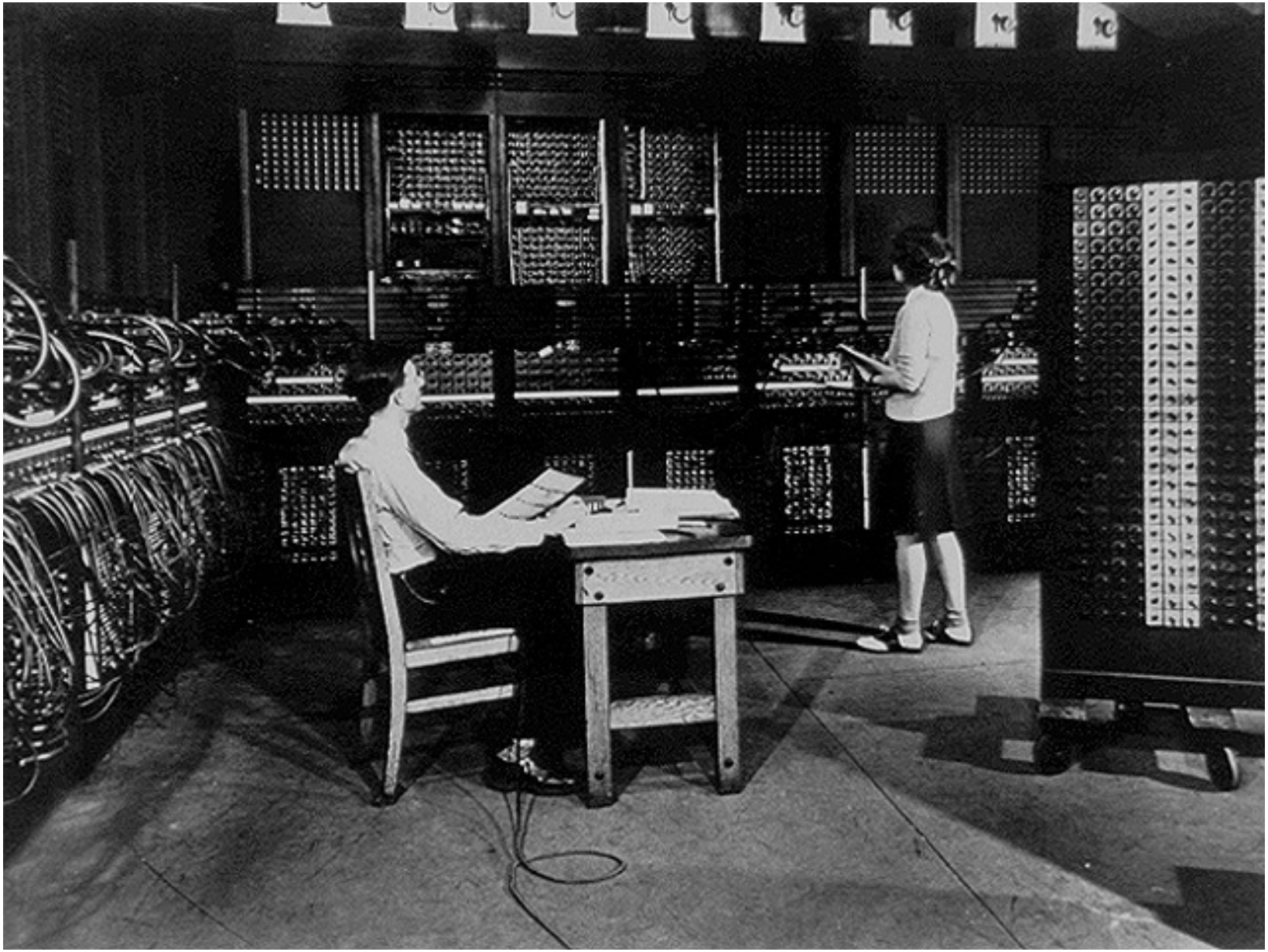
Abb. 7 Titelseite.
Scientific American 63(1890) No. 9.
(August 30, 1890)

Zuse and the Z1

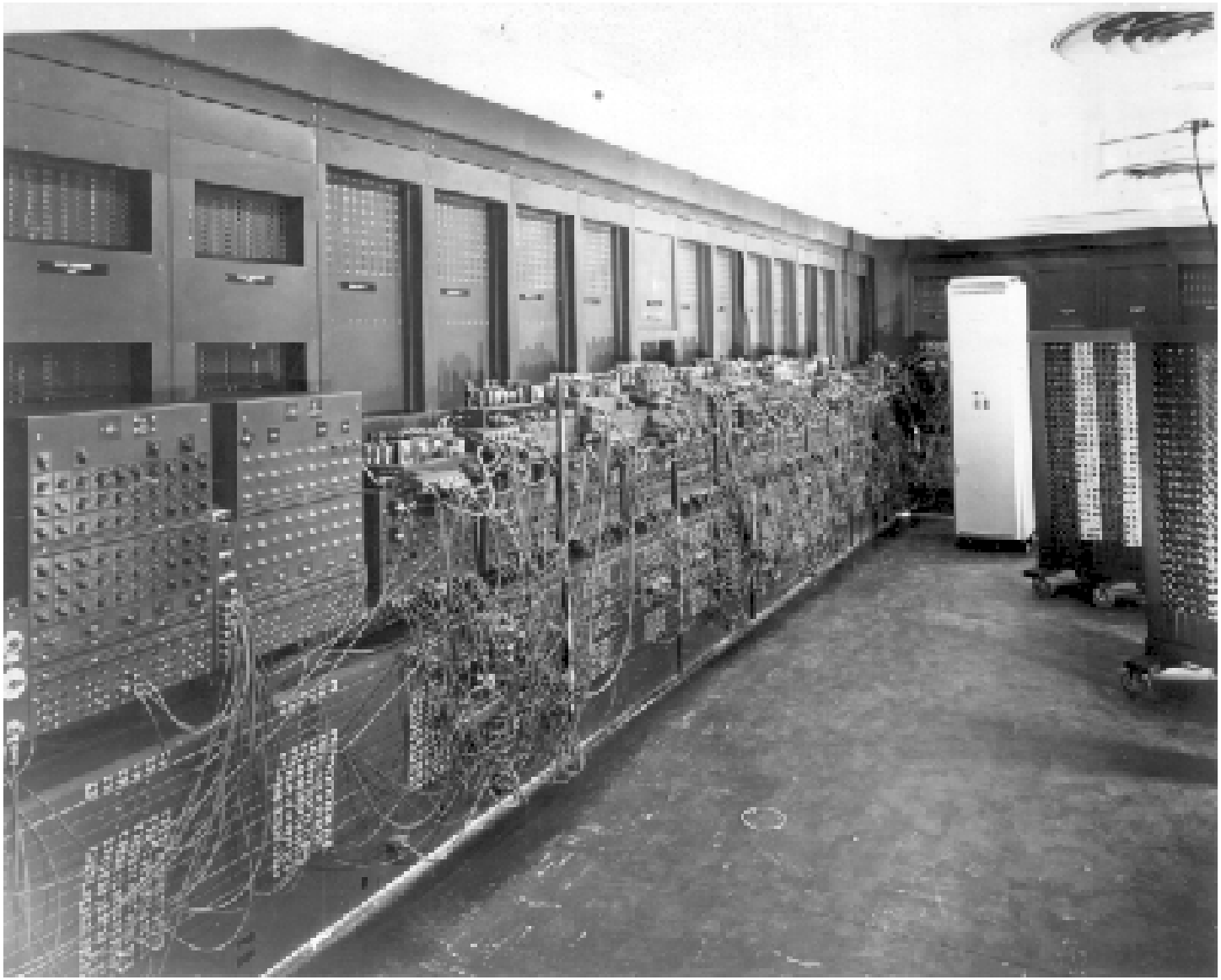
From 1936 to 1938, Konrad Zuse developed and built the first binary digital computer (Z1). A copy of this computer is on display in the Museum for Transport andTechnology in Berlin.

Zuse completed the first fully functional program-controlled electromechanical digital computer in the world (the Z3) in 1941, but it was destroyed in 1944 during the war.

The machine used electromechanical relays rather than vacuum tubes.



Eniac, 1946



Eniac, 1946

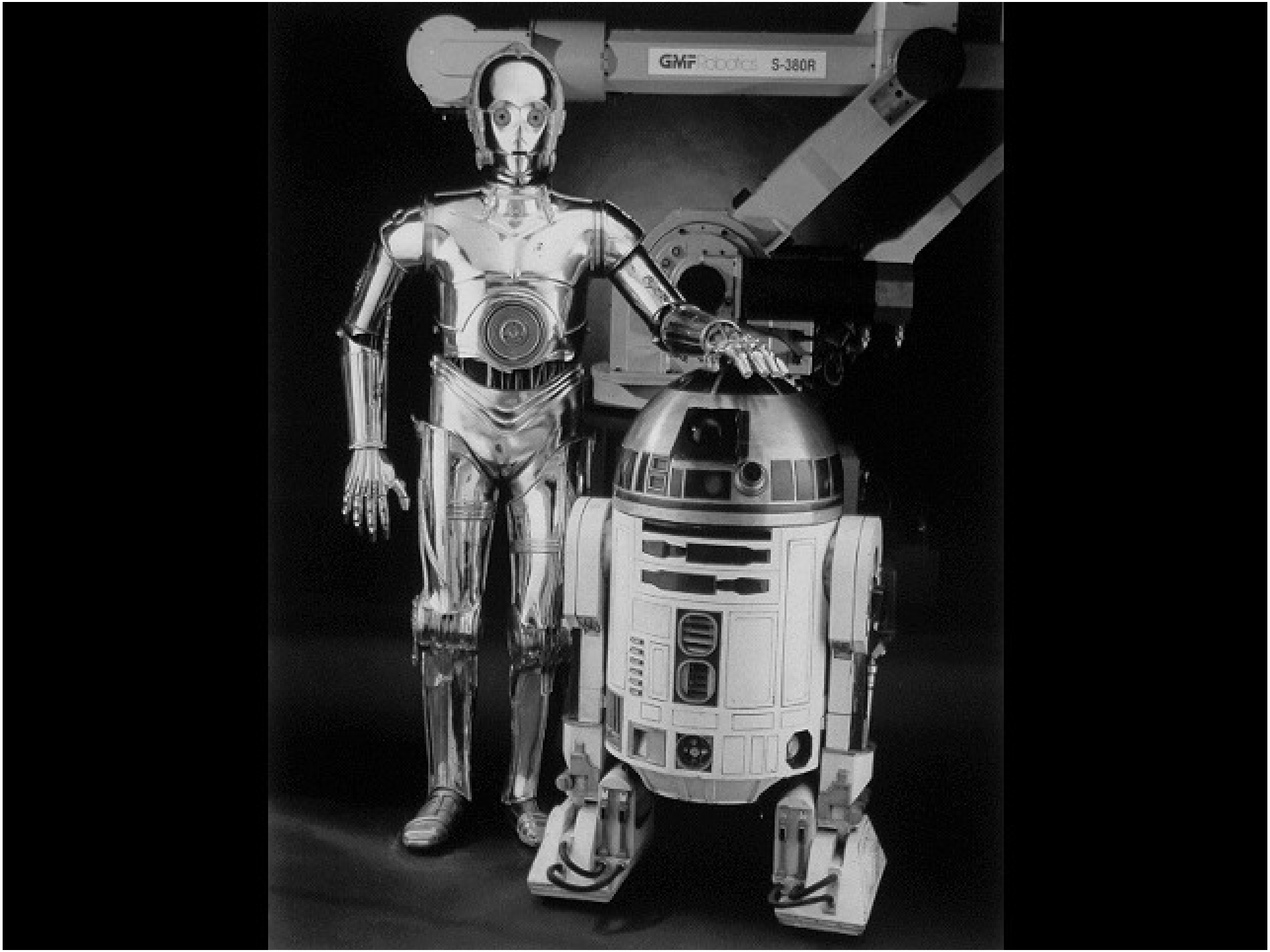
The Eniac

The ENIAC was a large-scale, general purpose digital electronic computer. Built out of some 17,468 electronic vacuum tubes, ENIAC was in its time the largest single electronic apparatus in the world. The ENIAC combined very diverse technical components and design ideas into a single system that could perform 5,000 additions and 300 multiplications per second.

Although slow by today's standards - current microprocessors perform 100 million additions per second - this was two to three orders of magnitude (100 to 1,000 times) faster than existing mechanical computers or calculators.

1971: INTEL 4004

The first single chip CPU was the Intel 4004, a 4-bit processor meant for a calculator. It processed data in 4 bits, but its instructions were 8 bits long. Program and data memory were separate, 1K of data memory and a 4K of program memory (in the form of a 4 level stack, used for CALL and RET instructions). There were also sixteen 4-bit general purpose registers.

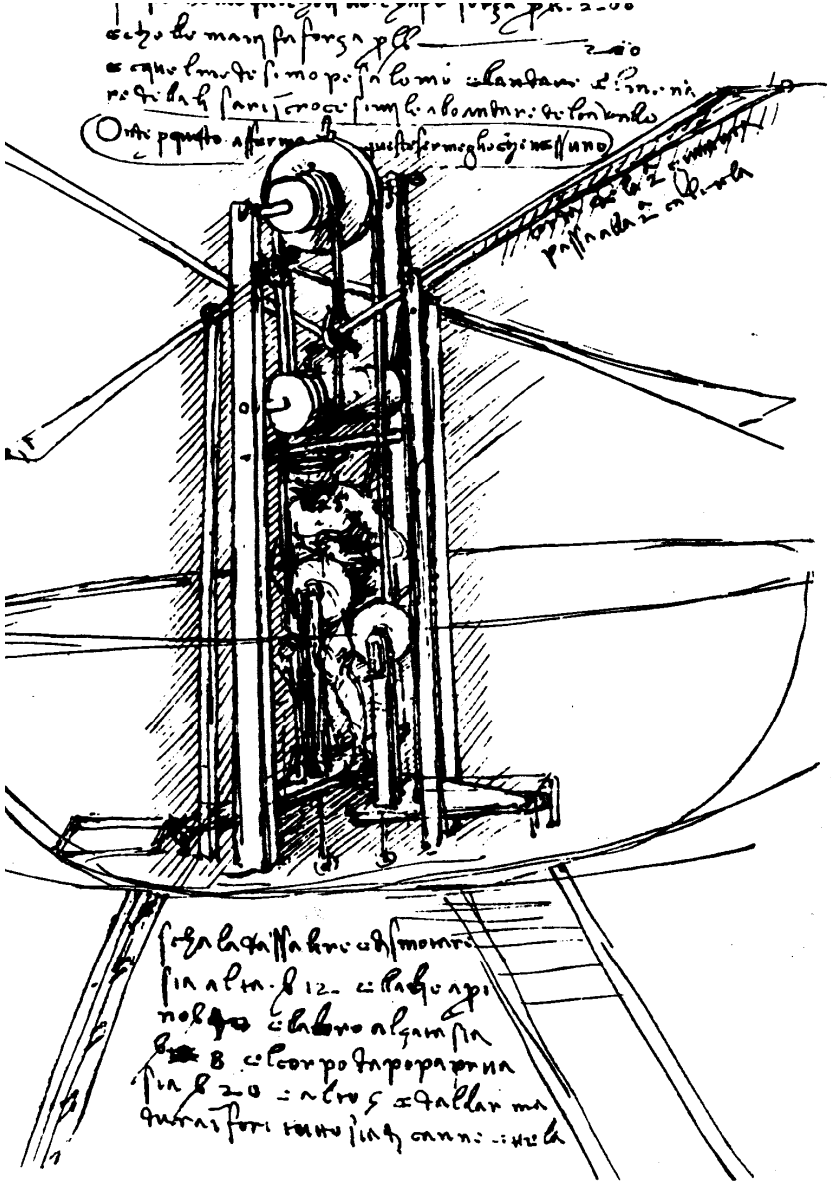

GMF Robotics S-380R

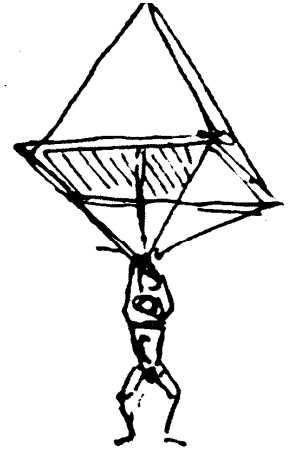
IBM PC 1981

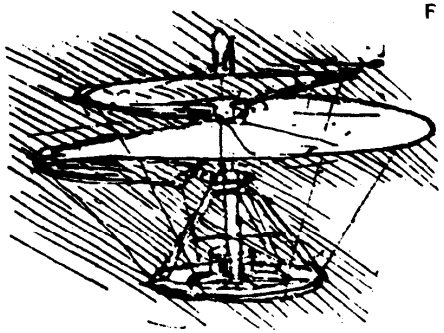
Aviation

What does he have to do with Aviation?

Leonardo's Helicopter 1485 A.D.







F

Self-portrait of Leonardo da Vinci. Sketch for a wing mechanism, based upon that of a bird, by Leonardo da Vinci.

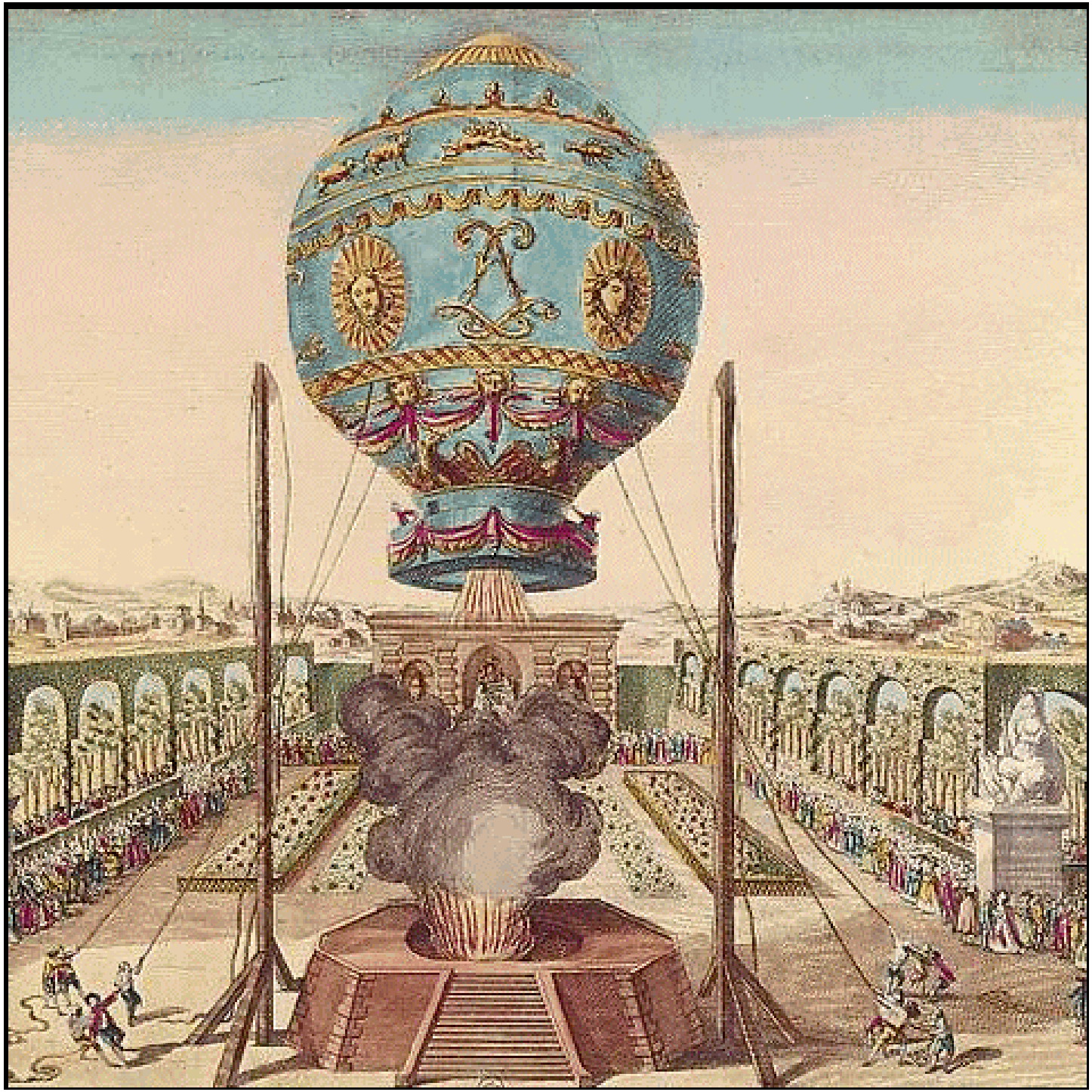
C *Da Vinci design for a flapping-wing aircraft, to be worked by both arm and leg movement, c. 1485.*

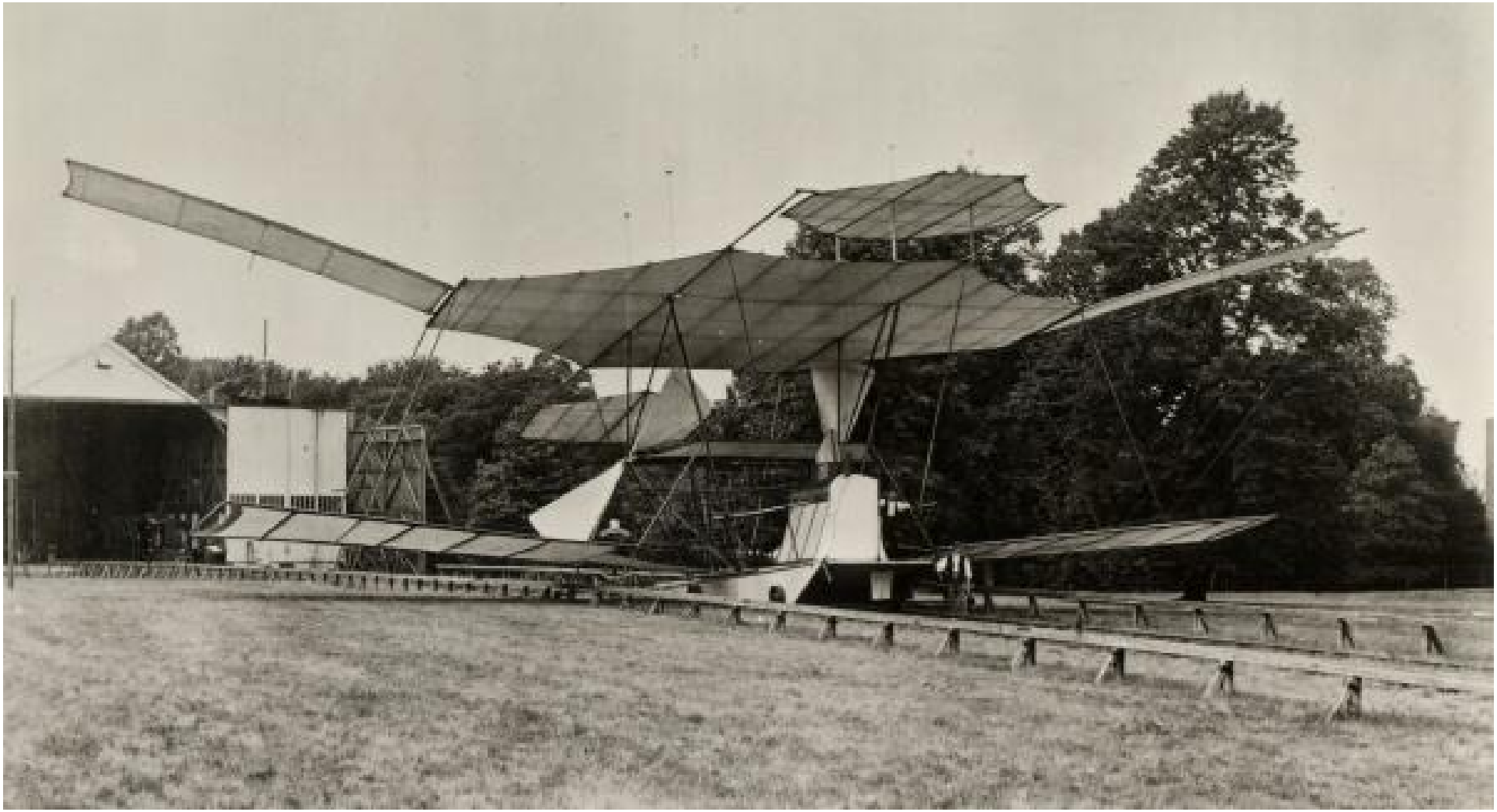
D *Ornithopter design by da Vinci, in which the pilot stood in a central structure.*

E *The earliest design for a parachute, by Leonardo da Vinci, c. 1485.*

F *Helix vertical take-off device, designed by Leonardo da Vinci, 1490.*

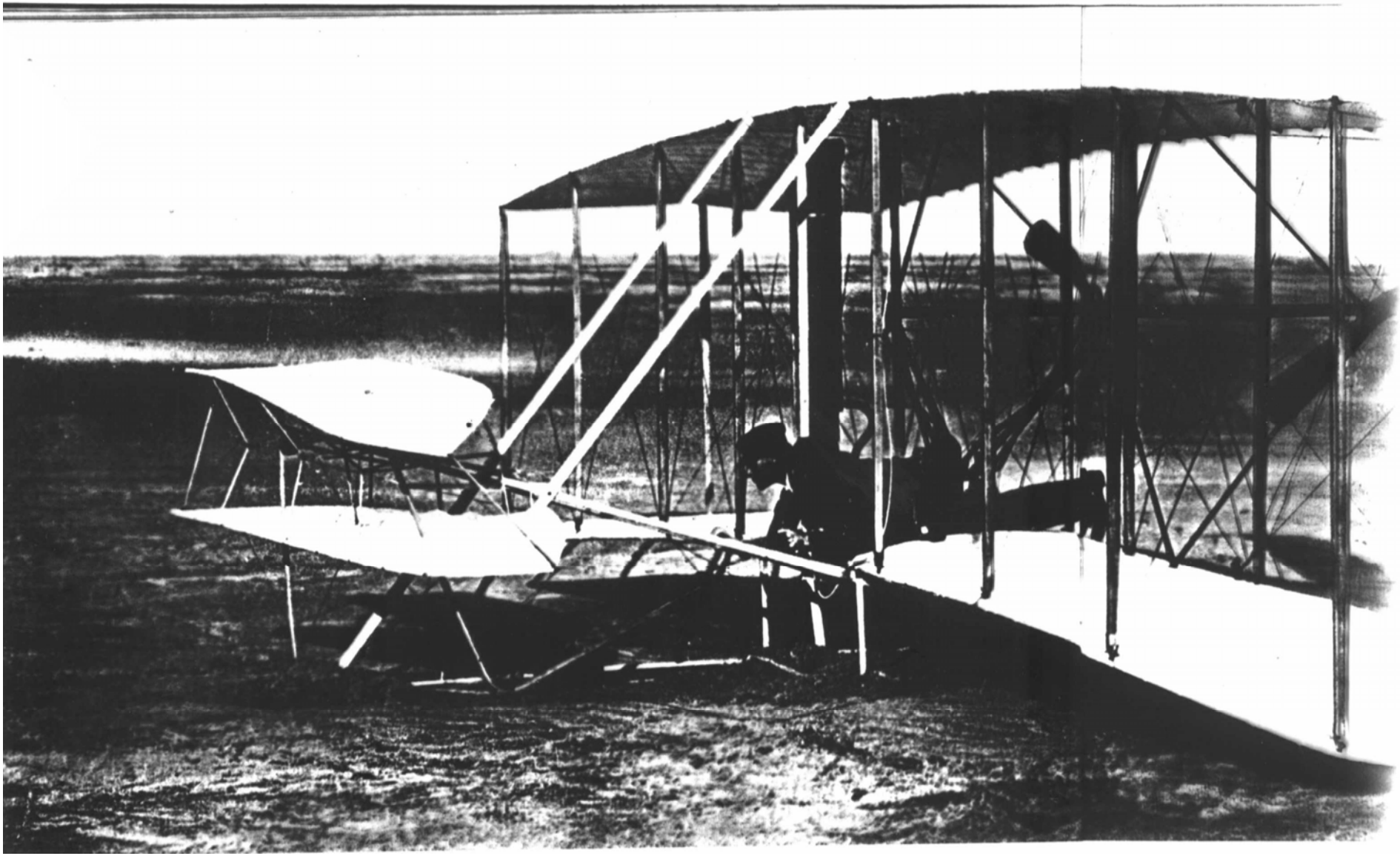
La Montgol fière 1783



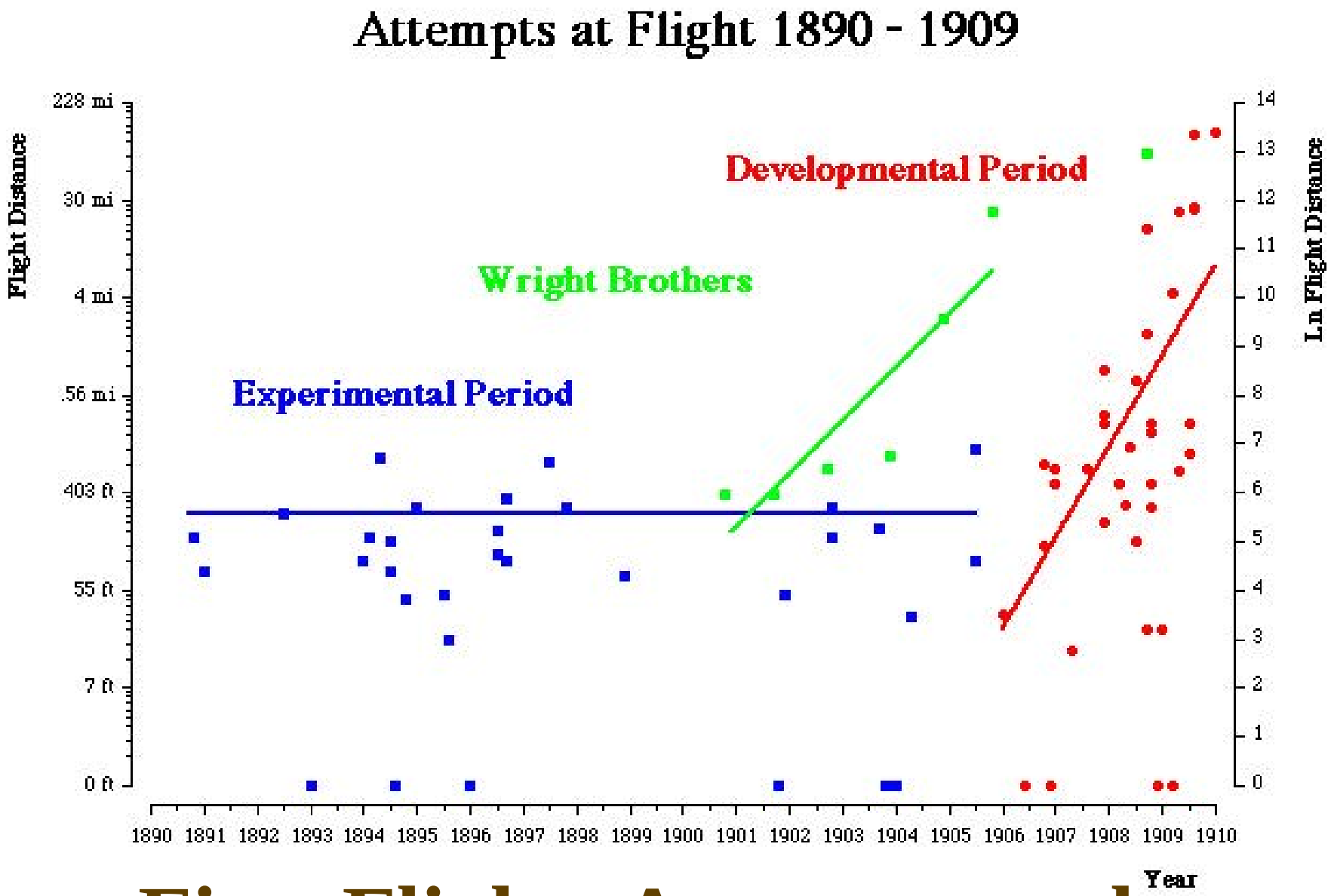


Hiram Maxim 1893

Otto Lilienthal 1895



First Flight: Wright Brothers 1903



First Flight: Attempts and Accomplishments

The Airplane as Computer

The Future of Aviation

The Future of Technology

- **More Automation. Why?**
- **How will automation shape future technologies?**
- **What do future technologies mean for YOU as future engineers?**

Globalization

Competition:

Production and Employment are mobile.

The End