

Montclair State University Department of Anthropology
Anth 140: Non Western Contributions to the Western World
Dr. Richard W. Franke

Week 13 Lecture

Chinese Contributions 01

Chinese Agricultural, Engineering, Household Technology and Industrial Contributions

This lecture was last updated 15 November, 2019
And 25 November, 2013

The Week 13 Lecture goes go with:

VIDEO: *Rise of the Dragon: The Genius That Was China*
[#2282, Part 1]

READING: Temple, Introduction and
Parts 1, 3 and 4; pages 6–13, 15–27, 41–73 and 75–121

Note: if your page numbers are different, go by the “Parts.”
Read all of Parts 1, 3 and 4 plus the Introduction.

Chinese Agricultural, Engineering, Household Technology and Industrial Contributions

The learning objectives for week 13 are:

- to know a few basic facts about China and Chinese history
- to recognize the recent history of anti-Chinese stereotypes in the West
- to appreciate several Chinese inventions including the iron plow, the double-acting piston pump, cast iron, steel, porcelain, matches, brandy (distilled liquors) and playing cards.

West and Non West

Terms you should know for week 01 are:

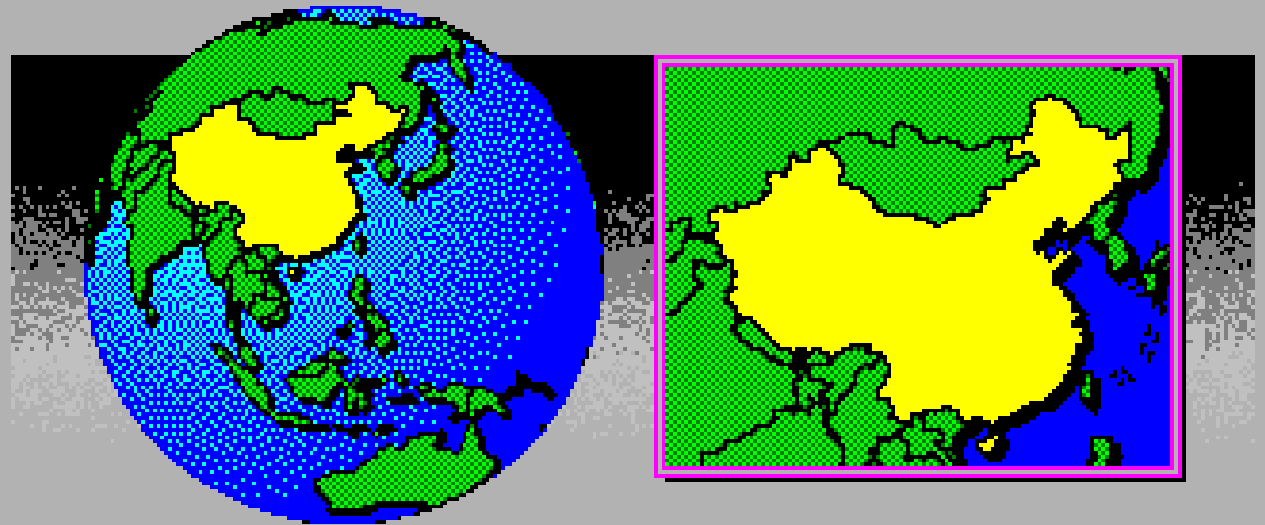
- Confucius
- Han
- “model minority”
- Song Dynasty
- Cast Iron
- Porcelain

Chinese Agricultural, Engineering, Household Technology and Industrial Contributions

Sources:

- Feldstein, Stanley, ed. 1972. *The Poisoned Tongue: A Documentary History of American Racism and Prejudice*. New York: William Morrow and Co. Inc. Page 110.
- Needham, Joseph. 1982. *Science in Traditional China: A Comparative Perspective*. Cambridge, Mass.: Harvard University Press.
- Temple, Robert. 2002. *The Genius of China: 3,000 Years of Science, Discovery and Invention*. London: Prion.
- Williams, Trevor I. 1960. *A Short History of Technology from the Earliest Times to A. D. 1900*. Oxford: Oxford University Press. Esp. p. 57.

1. Where is China?



2. China is one of the 4 largest nations on earth and has the world's largest population at 1.4 billion in 2019.

3. In 2019, China has 18.1% of the world's entire population. [vs. USA = 4.26%]

Source and update: [click here.](https://en.wikipedia.org/wiki/List_of_countries_by_population)

https://en.wikipedia.org/wiki/List_of_countries_by_population



5. China is ethnically and linguistically diverse with 55 recognized minority cultures.



6. 92% of Chinese are from the “Han” group.
7. In recent years China was much in the news because of its spectacular economic growth – but this has diminished greatly in the most recent times.
8. 10.7% estimated for 2006 – possibly more than 5 times the US rate for that year and in 2011 9.8%

8a. China's Growth Rate Recently Declining



Source: <https://tradingeconomics.com/china/gdp-growth-annual>

9. China may have the world's largest foreign reserve ownership – at 3.12 trillion US dollars

https://en.wikipedia.org/wiki/Foreign-exchange_reserves_of_China

10. According to Wikipedia

“Most of China's foreign-exchange reserves are held in U.S. dollar-denominated [financial assets](#) such as [U.S. Treasury securities](#).^[9] Since 2008, when it overtook [Japan](#) in this respect, China is the largest foreign owner of [U.S. Treasury securities](#),^[10] accounting for about 22 percent of all U.S. Treasuries held by non-Americans.^[11]”

https://en.wikipedia.org/wiki/Foreign-exchange_reserves_of_China

Updated: 15 November, 2019

11. Along with India, China's growing economic, political and military power has led some observers to predict that these two nations will increasingly determine the future of the entire world economy as the US and other advanced countries decline in relative strength.

2013 Update

11b. China – and to a lesser extent India – are now experiencing the equivalent of the earlier European industrial revolution – but at 1,000 times the speed and impact.

Source: Gardner, Gary. 2013. Conserving Nonrenewable Resources. Chapter 9 in *State of the World 2013: Is Sustainability Still Possible?* Washington D.C.: Island Press. Pages 99-109. Slide data from page 100.

2013 Update

11c. China's \$8.4 trillion economy in 2012 was by far the largest in Asia, with Japan second at \$5.5 trillion and India third at \$1.8 trillion. By contrast, China's population at 1.4 billion is barely greater than India's at 1.3 billion people.

12. Whatever the future might hold, China has a longer history of scientific and technological innovations than does the Western world.

13. Indeed, many of the West's most important achievements originated in China.

14. British biochemist turned China science historian Joseph Needham lists the famous four as:

- The compass
- Gunpowder
- Paper
- Printing

15. We shall consider several major Chinese contributions to the Western world in this set of slides.

16. But first let us note two important facts about China and Chinese history –

- 16.1 Western attitudes towards China have previously been as racist and condescending as they were towards Africans
- 16.2 Chinese culture – while ancient – is not as old as Egypt and indeed may have been influenced by both Egypt and ancient Sumer

Anti-Chinese Stereotypes

17. Chinese, Japanese and Filipino immigrants in 19th century America were usually lumped together as “Chinese.”
18. Congress passed a special “Chinese Exclusion Act” in 1882 and made a “gentleman’s agreement” with Japan in 1908.

Anti-Chinese Stereotypes

19. 19th century attitudes included the “mongol mind” theory that Chinese were incapable of abstract thinking, but that “children are taught...by material emblems...they have no history...” etc.

Anti-Chinese Stereotypes

20. Other stereotypes: the “Asian mind” as

- Mysterious and “inscrutable”
- Obsessed with “saving face”
- Violent and lacking concern for human life – used a lot during both Korean and Vietnam wars
- Hapless victims and prostitutes (the Suzie Wong stereotype)

Anti-Chinese Stereotypes

21. And – ironically perhaps – the more recent
“model minority” image of
- The Asian-American math whiz and
 - Violin virtuoso

Anti-Chinese Stereotypes

22. Behind all the stereotypes has been a lingering Western fear of what was sometimes called “the yellow peril,” a phrase that could refer to
- Any or all of the previous stereotypes plus
 - The idea of Chinese masses overwhelming other groups because of their large numbers

Anti-Chinese Stereotypes

23. Anti-Asian stereotypes have greatly diminished in the last several decades and a new Western interest in China and its history has developed as well

Ancient Chinese History

24. Much of the renewed interest in China has revolved around ancient Chinese history.
25. And interest in the science and technology of China received a boost from the work of British biochemist turned science historian Joseph Needham.

Ancient Chinese History

26. Let's look at a few basic facts about China's ancient history.

Ancient Chinese History

27. The earliest
recorded central
government in
China is the
Shang dynasty –
founded in 1766
BC



Ancient Chinese History

28. This is about the time of:

- The late part of the Egyptian Middle Kingdom
- The historical Abraham of the Bible
- Hammurabi of Babylon – first known written code of laws

Ancient Chinese History

29. In other words, Chinese civilization is much older than Europe's but much more recent than in Egypt and Mesopotamia

Ancient Chinese History

30. The philosopher **Confucius** was probably ancient China's most important thinker

- 551–479 BC
- Theory of benevolent bureaucracy
- Emperor has “mandate of heaven”
- Same time as Buddha [563–483]



Ancient Chinese History

31. Qin Dynasty – 221–206 BC



Ancient Chinese History

32. During Qin Dynasty

- Chinese writing system standardized
- Weights and measures
- Great wall begun

33. The
Great
Wall of
China is a
tech-
nological
and
engineeri
ng
marvel
...but...



34. ...It
ultimately
failed to
protect the
Han
population
from attacks
by nomads
including the
Mongols



35. From 202 BC
to 220 AD
China
experienced
the Han
Dynasty
during which
China became
a powerful
empire



Ancient Chinese History

- 35a. The Han Dynasty corresponds approximately with the Roman Empire and the two were often trading partners.
- 35b. They occasionally exchanged diplomatic missions.

Ancient Chinese History

36. During the Han Dynasty in 111 BC China conquered and ruled Vietnam as a Chinese province for more than 1,000 years until 939 AD when the Vietnamese won their independence.
37. Vietnam was then called “Annam,” or “pacified south”

Ancient Chinese History

38. The Tang Dynasty (also called “zhou dynasty”) ran from 618 AD to 907 AD



Ancient Chinese History

39. The Tang Dynasty witnessed many important Chinese inventions that we shall note soon.

Ancient Chinese History

40. From 960 to 1279 AD was the Song (or “Sung”) Dynasty in which many important Chinese inventions were made or further developed.

Ancient Chinese History



Chinese Agricultural Inventions

41. One important area of Chinese innovation was agriculture.

Chinese Agricultural Inventions

42. The Chinese invented

- Row cultivation 6th century BC
- Intensive hoeing 6th century BC
- Rotary winnowing fan 2nd century BC (Han Dynasty)
- Multitube seed drill 2nd century BC (Han Dynasty)
- Iron plow 6th century BC

Chinese Agricultural Inventions

43. Let's consider the plow with seed drill and adjustable blade

44. The Sumerians (ancient Iraq) may have invented the first plows around 4,000 BC.

Chinese Agricultural Inventions

45. The earliest plows were pointed sticks probably harnessed to humans, then later on to oxen.

46. Around 3,000 BC the Egyptians added a triangular shaped stone plowshare (or blade) that cut the soil more effectively.

Chinese Agricultural Inventions

47. The plow is thought to be crucial to the large-scale production of food and therefore is part of the farming basis of the industrial revolution in Europe.

Chinese Agricultural Inventions

48. European plows were little advanced over their ancient Egyptian ancestors until about the 17th century when Dutch sailors brought Chinese plows back to Holland. (The moldboard seems to have been adopted in Europe by the 14th century in some places.)

Chinese Agricultural Inventions

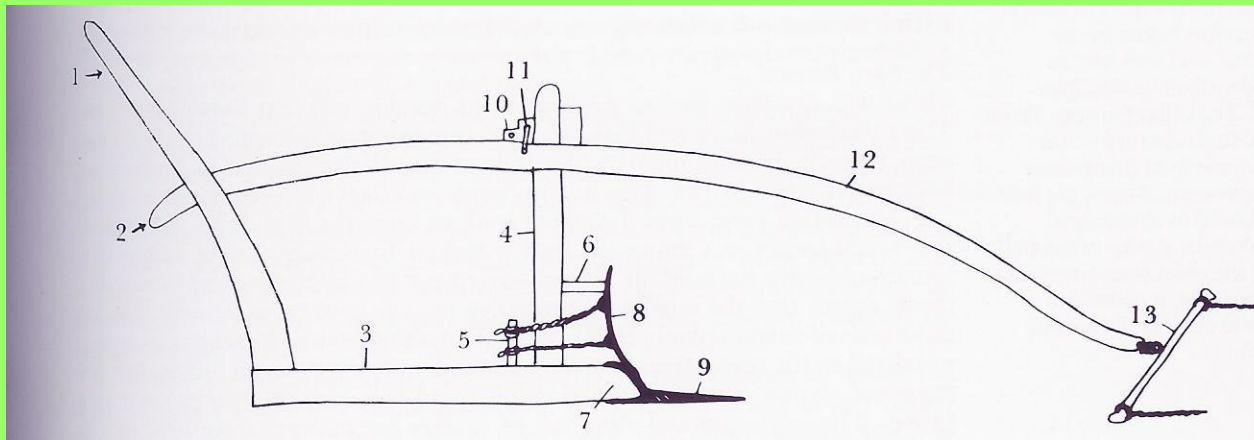
49. The Chinese plow, developed around the 6th Century BC, revolutionized agricultural production in Europe in the 18th and 19th centuries.
50. European and American inventors – including John Deere – made significant improvements on the Chinese plow once it had been imported to the West.

Sources: Temple, Robert. 1998. *The Genius of China: 3,000 Years of Science, Discovery and Invention*. London: Prion Books Limited. Esp. pages 15–27; Derry, T. K. and Williams, Trevor I. 1960. *A Short History of Technology from the Earliest Times to A. D. 1900*. Oxford: Oxford University Press. Esp. p. 57.

Chinese Agricultural Inventions

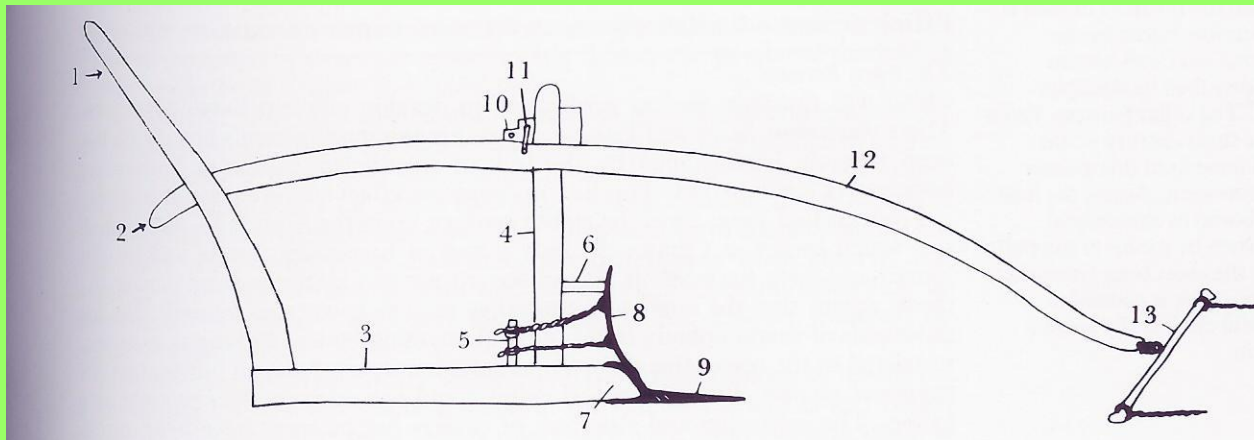
51. The Chinese plow had five major innovations:

- 51.1 An iron plowshare or blade (9)



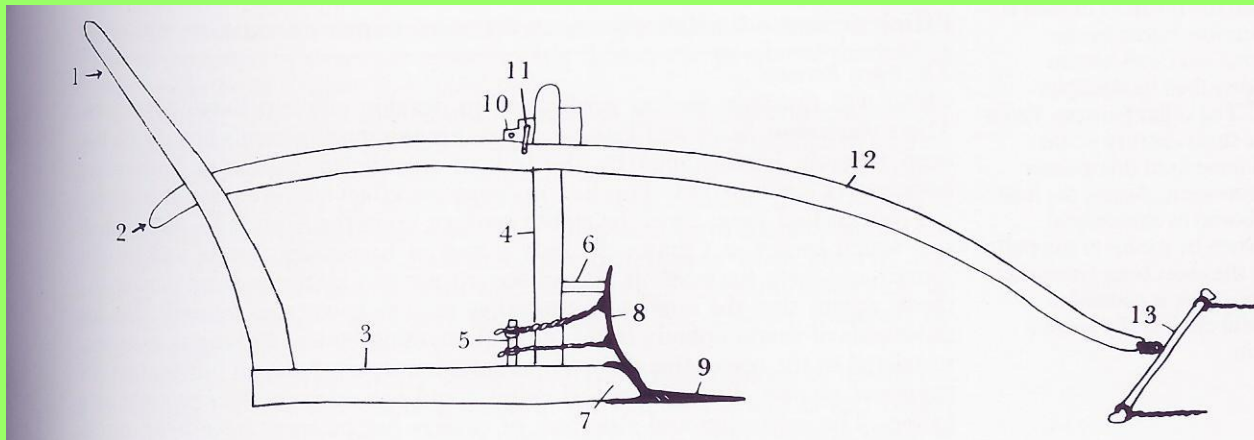
Chinese Agricultural Inventions

51.2 Adjustable depth of the plowshare (4). This made the plow adaptable to various soil and moisture conditions.



Chinese Agricultural Inventions

51.3 A moldboard that turned the soil after it was cut by the blade – this mixed the different levels of soil and also facilitated oxygen absorption by the soil (8). The moldboard also turned the plowed soil away from the plow thus significantly easing the work since the soil did not pile up on the blade.



Chinese Agricultural Inventions

51.4 A seed drill (2nd century BC) that (not shown) facilitated planting in straight rows which used fewer seeds and spaced them for optimal harvest output.

51.5 A harness that did not choke the animal pulling the plow

Chinese Agricultural Inventions

52. The ancient
plow
remains in
use today in
China



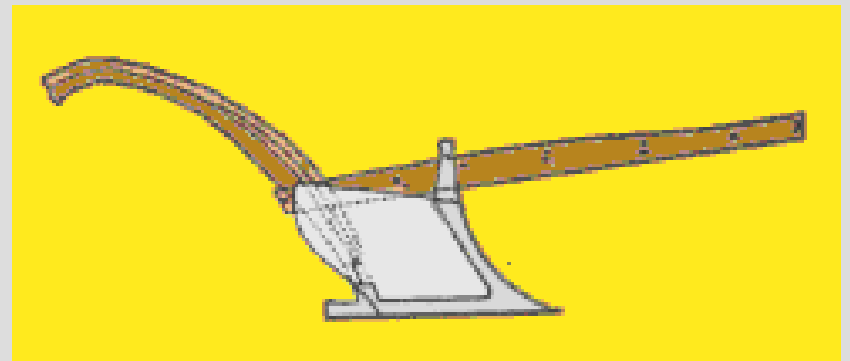
Chinese Industrial Contributions

53. Cast Iron

The Chinese produced this superior quality metal as early as the 4th century BC. It was known in Europe only by the 8th century AD. Cast iron requires the addition of up to 6% phosphorus which reduces the melting point of the iron from 1130° to 950° Centigrade.

Chinese Industrial Contributions

54. The widespread availability of cast iron in ancient China led to the development of the iron plow – described earlier – iron hoes, and knives, axes, chisels, and saws.



Chinese Industrial Contributions

55. Thin, lightweight cooking pots, lighter and longer swords, and large building structures were all made possible by cast iron. In the 3rd century BC, the Chinese discovered the process of "annealing" -- holding cast iron at a high temperature for a week or more. This made the iron far stronger. It was nearly the quality of steel.

Chinese Industrial Contributions

56. Steel

Henry Bessemer, official inventor of the steel making process in 1856 had learned it in part from William Kelly. Kelly had brought 4 Chinese steel experts to Eddyville Kentucky in 1845. They taught him the Chinese steel process that was by then over 2,000 years old.

Chinese Industrial Contributions

57. The first important development in steel making is to expel some of the 4-5% carbon content of cast iron. Chinese metallurgists accomplished this in 120 BC by blowing oxygen onto the cast iron.

Chinese Industrial Contributions

58. The second important development is to fine-tune the amount of carbon so that it is just in between wrought iron and cast iron. In the 5th century ^{AD} Chinese metallurgists developed the "co-fusion" process to accomplish this. Co-fusion is the technique used by Martin and Siemens in 1863 to make industrial steel in the West.

Chinese Industrial Contributions

59. The Double-Action Piston Bellows

- Chinese metal working and the Chinese chemical industry (see next week) were both facilitated by their ability to maintain high and steady temperature fires.

Chinese Industrial Contributions

60. This was largely facilitated by the double-action piston bellows.

61. The Egyptians may have invented the first single-action pumps around 2,500 BC.

Chinese Industrial Contributions

62. The single-action pump leaves gaps in pushing air over a fire because no air is pushed while the piston is being pulled back for the next stroke.
63. This limits the amount of high even heat the bellows can provide to the fire.

Chinese Industrial Contributions

64. By inventing the double-action piston bellows, the Chinese achieved very high and even temperatures making possible their great advances in metallurgy.

Chinese Industrial Contributions

65. Double-action bellows were also used in baking and may have been used in the manufacture of medicines.

66. The double-action piston bellows was invented in China by at least the 4th Century BC.

Chinese Industrial Contributions

67. This technology became known in Europe from contacts with China only by the 16th Century.

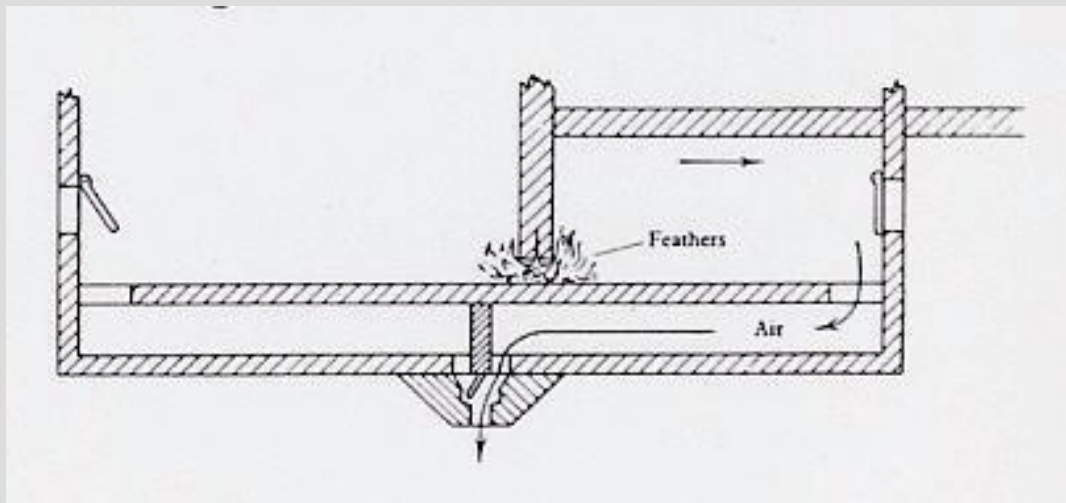


Chinese Industrial Contributions

68. Or, China was about 2,000 years ahead of Europe in developing a practical technology based on pistons, vacuums, and valves.

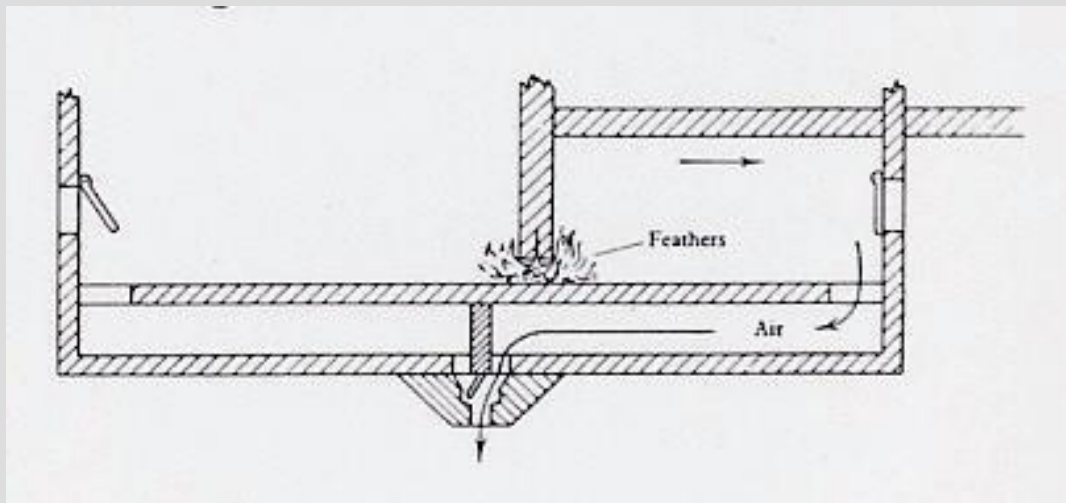
Chinese Industrial Contributions

69. The piston is being pulled out to the right, compressing the air in the right-hand chamber and forcing it out of the nozzle at the bottom.



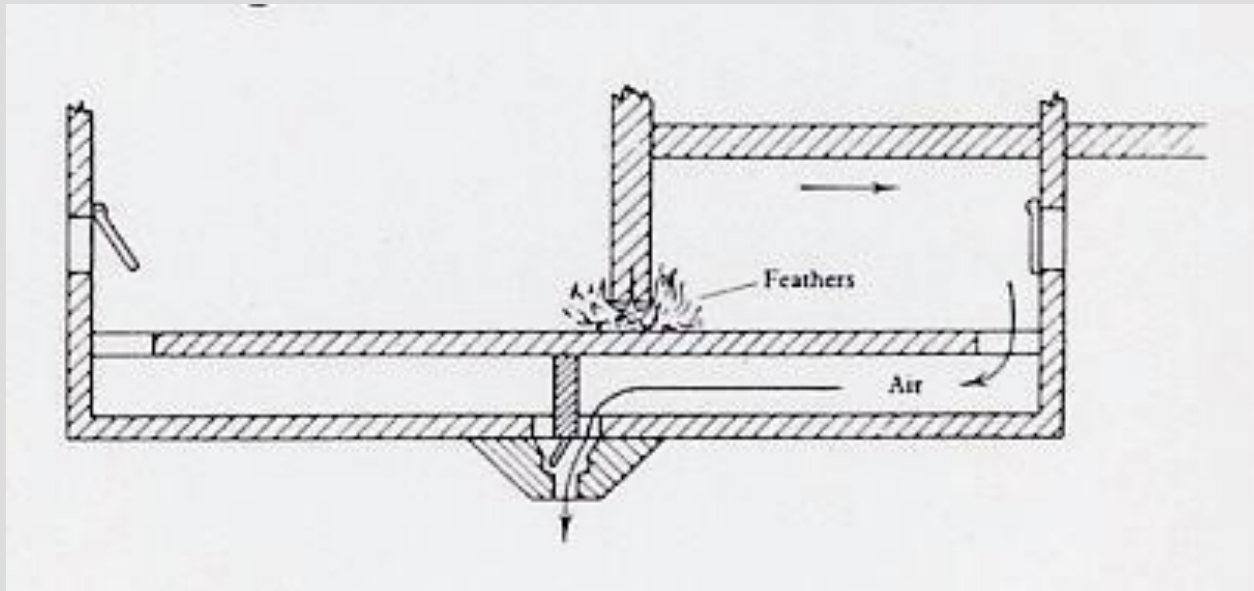
Chinese Industrial Contributions

70. When the piston is pushed back to the left, air is compressed in the left-hand chamber and forced from the nozzle once more.



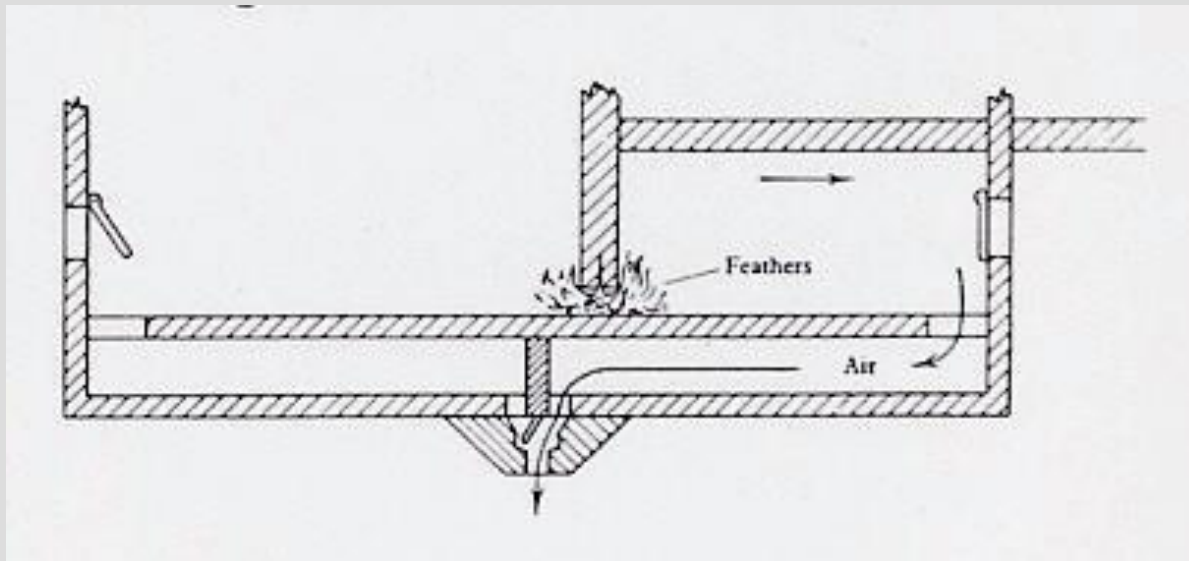
Chinese Industrial Contributions

71. The feathers lubricate the movement of the piston while sealing off the air around its edges.



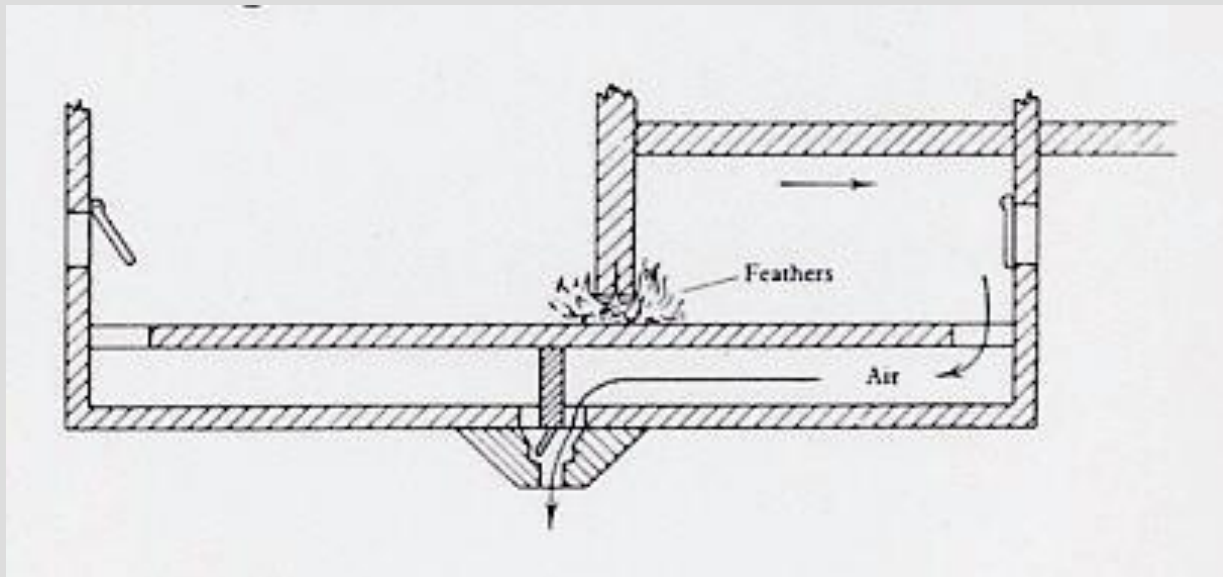
Chinese Industrial Contributions

72. The nozzle has a valve like a swinging door. It can open in either direction in response to the air flow.



Chinese Industrial Contributions

73. The double-action piston bellows anticipates the properties of the internal combustion engine. Do you see how?



Chinese Household Technology Contributions

74. Matches

- Invented by a Chinese woman around 577 AD
- Appeared in Europe by 1530 AD
- Sulfur tips burst into flame when struck across a hard surface

Chinese Household Technology Contributions

75. The umbrella

- Name is Italian for “little shadow”
- Invented in China in 4th century AD
- First oiled paper then silk
- May have first been used as sun parasols rather than for rain

Chinese Household Technology Contributions

76. Porcelain

A type of pottery first made in China during the Tang dynasty (618–907 AD). It may even have begun in the Han Dynasty around 200 AD.





Chinese Household
Technology Contributions
77. Porcelain is shaped on a
potter's wheel or in a
mold, then painted,
glazed and fired in a kiln
at a high temperature.

Porcelain

78. It became known in the West as "China," still a name used for the finest tableware. The secrets of porcelain are the use of a pure clay known as *kaolin*, and the ability to fire it at temperatures as high as 1280° Centigrade.



Chinese Household Technology Contributions

79. Today porcelain is in great demand for all kinds of kitchen and bathroom appliances.





Porcelain

80. It does not scratch or mar easily and because the surface lacks pores, it is highly resistant to the accumulation of bacteria.

Chinese Household Technology Contributions

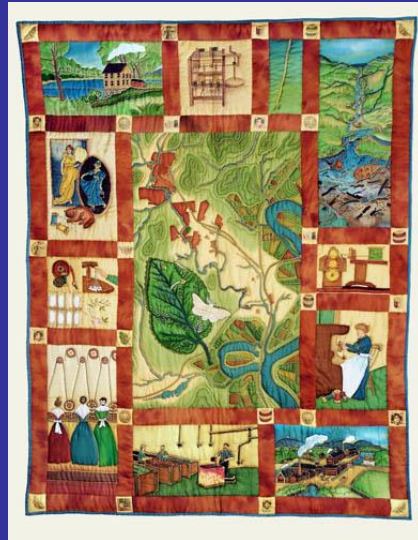
81. Silk

As early as 3,000 BC
Chinese farmers
invented the process of
making silk thread from
the cocoon of the
silkworm.



Silk

82. The shimmering appearance for which silk is prized comes from the fibers' triangular prism-like structure which allows silk cloth to refract incoming light at different angles.



Silk

83. The oldest known silk comes from an Egyptian mummy in 1070 _{BC}, indicating that Chinese silk had become an item of ancient international commerce.

Silk

84. Silk production is a complex industry involving the silkworms, mulberry bushes for the worms to eat the leaves off, and silk producing baskets where the worms are effectively domesticated.



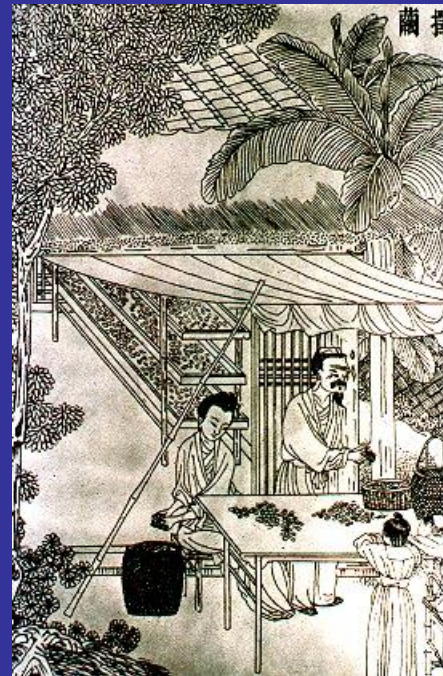
Silk

85. Silk production is called “sericulture.”



Silk

86. Silk production
requires manufacturing
the thread, spinning it,
dyeing and weaving



Silk

87. In 553 AD Byzantine monks managed to steal silkworm technology from China, weakening its monopoly on the silk trade.

Silk

88. Eventually major silk industries developed in

- India
- Thailand
- France
- Ireland

Silk

89. The modern silk industry is associated with an elaborate vocabulary of specialized weaves and textures

- Brocade, chiffon
- Charmeuse, doupiono, noil, faille
- Etc.

Chinese Household Technology Contributions

90. Along with its beauty, silk is a very practical product, lightweight, strong, and providing good insulation or breathability as required.

Chinese Household Technology Contributions

91. Paper

- In 105 AD, Cai Lun invented modern paper, by cooking hemp, bamboo or flax until they became a sticky paste.



Chinese Household Technology Contributions

92. He then spread the
mixture into
rectangular molds.
When the sheets were
dry...



Chinese Household Technology Contributions



93. ...the paper was used for writing, fans, kites, screens, and by the 7th century, for paper money – itself a Chinese invention.

Chinese Household Technology Contributions

94. Brandy

The English word "brandy" comes from the Dutch word "brandewijn." The Dutch word means literally "burnt wine." It is apparently a literal translation of the Chinese *shao chi*, which means, "burnt wine."

Chinese Household Technology Contributions

95. Brandy is wine that has been distilled – much of the water crystals frozen and/or burnt out. The distillation process was probably discovered by Central Asian peoples who noticed that small amounts of wine in the center of a container would not freeze even at the coldest temperatures.

Chinese Household Technology Contributions

96. Chinese scientists in the 7th century AD developed the first stills, in which wine was burnt to separate or distill out the most alcoholic concentrates.
- Our word "alcohol" comes from Arabic.

Chinese Household Technology Contributions

97. Beer and wine – alcoholic drinks that are only fermented and not distilled – probably originated in ancient Egypt or ancient Sumer.
98. Distilled drinks have 35% or more alcohol content whereas fermented drinks are below 15%.

Chinese Household Technology Contributions

99. Chess

- This game came to the West from India and Persia about 600 AD. The word "checkmate" probably comes from the Persian "shah maat," which means "the king is dead." Chess has been traced to China as early as the 6th century BC.

Chinese Household Technology Contributions



100. Playing cards

- Marco Polo may have brought cards on his return from China in 1295 AD



Chinese Household Technology Contributions



101. Cards were invented in China in the 9th century
102. They became popular almost immediately

Chinese Household Technology Contributions

103. Chinese cards
innovated the four suits
that now characterize
the typical European
and North American
decks or sets of cards.



104. 2013 Update: Maybe – Skis and Skiing

Still debated but see the
December 2013 National
Geographic for update:

Source: <http://ngm.nationalgeographic.com/2013/12/first-skiers/jenkins-text>



End of Week 13 Lecture

China 01

Chinese Contributions 01

Chinese Agricultural, Engineering, Household Technology and Industrial Contributions