FIRST INDUSTRIAL REVOLUTION IN AMERICA: 1790-1860
Born in England in 1768. He was apprenticed to a partner of Arkwright’s for eight years, during which time he became superintendent of the cotton mill and learned how the Arkwright machines and mill operated.

In 1789, Slater decided to emigrate secretly to America. The British government had laws forbidding skilled mechanics from leaving.

While the textile industry was long established in Great Britain, it was just starting in America. Slater believed he could become wealthy in America's infant textile industry.

Slater was not the first immigrant with textile experience, but he was the first who knew how to build and operate textile machinery.
By 1790, Slater and his partners built one of the first factories in America on the Blackstone River in Rhode Island.

In 1793, they built Slater Mill, the first American factory to successfully produce cotton yarn with water-powered machines.

Within a few years there were hundreds of mills/factories turning out cotton yarn.

Water power demonstration website: you must be on the internet.

http://www.nps.gov/lowe/photosmultimedia/waterpower.htm
The Old Slater Mill, Pawtucket Rhode Island.

Built by Samuel Slater in 1793, and in which was first introduced in America the spinning of Cotton by machinery.
Slater's mill replaced this with this
Inside Slater Mill
Slater Mill today
Eli Whitney (1765-1825)

- American inventor and entrepreneur
- Invented the cotton gin
- Popularized the system of interchangeable parts
- His innovations greatly impacted American history
Cotton is an ancient crop first grown in both South America and India over 6,000 years ago. Only rare sea island or long-staple cotton could be grown profitably before Eli Whitney’s invention. Short-staple cotton, a species that could be grown in wider areas, was unsuitable because it contained hundreds of seeds that had to be removed by hand. Eli Whitney invented a machine that mechanically removed seeds and made short-staple cotton a viable crop.
Jefferson's letter of November 16, 1793, is a reply to Whitney's application to the federal government for a patent for his invention. Jefferson gives Whitney the requirements to obtain a patent, and asks for more information because he is interested in purchasing a gin for his plantation in Virginia.
Whitney’s patented cotton gin was soon copied by many others. He spent years and thousands of dollars trying to uphold his patent.
When Whitney invented his machine, the South was at a turning point regarding slavery.

The high cost of maintaining slaves made the crops produced by slave labor, such as tobacco, indigo, and rice, less profitable.

The cotton gin changed this by making short-staple cotton the most profitable cash crop. Cotton production required cheap labor, and the demand for slaves exploded.

Slavery became a permanent fixture; few, if any, southerners spoke out against it.

Slavery was the backbone of the prosperous economic system in the South.

It is estimated that in the 11 southern slave states income derived from slave labor ranged from 17% to over 30%.
Whitney and his partner set up cotton gins throughout the South.

Instead of charging money, Whitney took two-fifths of the crop farmers brought in to be ginned. Farmers, angry at the high price, began making their own versions of the cotton gin.

After a long and largely unsuccessful struggle, Whitney gave up defending his patent and returned to New Haven, Connecticut, in 1798.
Cotton exports, in pounds, before and after invention of the cotton gin
Growth in number of slaves after invention of the cotton gin
Cotton as % of U.S. exports, 1800-1860

By 1850, America was growing three-quarters of the world's supply of cotton. The majority of southern cotton was shipped to New England or exported to Great Britain where it was turned into cloth.

Note: In 2005, the U.S. was still the world leader in cotton production.
Growth of cotton production (bales) and slave population
ELI WHITNEY
and
The American System of Manufacturing
As the Napoleonic wars broke out in Europe, Whitney knew that the U.S. army would need a new source for muskets to arm its soldiers.

Traditionally, muskets had been made one at a time by skilled craftsmen. No two muskets were alike, and parts from one would not fit another.

Whitney proposed to produce muskets with interchangeable parts. He demonstrated his procedure to government officials, who gave him a contract.

The contract called for Whitney to produce 10,000 muskets in two years.

It took Whitney eight years to fulfill the contract. A second contract called for him to produce 15,000 muskets, which he accomplished in two years.

He invented a new system using high-precision tools to manufacture parts. The parts could be assembled by any unskilled worker, and were entirely interchangeable.
Whitney’s arms factory. It was later sold to Winchester Repeating Arms Company, and is today a museum.
The U.S. government complained that Whitney’s muskets were more expensive than those of other manufacturers. Whitney showed them, through an early use of the now-common business practice of cost accounting, that his were not over-priced.
Whitney had to invent new machines to fulfill his contract. Some historians credit him with creating the “American System of Manufacturing.” This system involves the use of power machinery, interchangeable parts, and a division of labor. Whitney came up with new ideas about manufacturing and made a lasting contribution to the Industrial Revolution in America.

Power-driven drill press

Milling machine
Creation of national markets

Roads and turnpikes *

Canals *

Steam power

Early railroads

Clipper ships

*Turnpikes are roads that charge money (tolls) to users. Canals are man-made waterways.
Cost of moving one ton of goods one mile in the early 19th century

30 cents = $5.00 in 2006 money
Canal Era
Many Americans wished to duplicate the financial success of the English Bridgewater Canal of 1761.

A proposal to construct a canal was pushed through New York state government by the governor, De Witt Clinton.

The planned canal would be 363 miles long, 40 feet wide and 4 feet deep. 83 locks had to be built to deal with the different water levels.

Many thought the idea crazy and called it “Clinton’s Ditch” or “Clinton’s Folly.”

Construction began in 1817 and was completed in 1825.
The Erie Canal was a financial success.
The canal linked New York City, by the Hudson River in the east and the Great Lakes in the west, all the way to the Ohio River.
The success of the Erie Canal cemented New York City as the greatest commercial center of the United States.
Average freight costs from Buffalo to New York City fell from 19 cents per ton per mile in 1817 to 2 to 3 cents during the 1830s.
The success of the Erie Canal led to a “canal boom,” with over 4,254 miles built before the boom ended in 1860. Most of the canals were financial disasters.
Opening the Erie Canal, 1825
Canals built during the canal boom are shown in red.
1860 cost to transport one ton one mile in cents (15 = 15 cents)

Erie Canal: Dady Brothers: click to hear

- road
- river
- erie canal
- great lakes
- ocean

cost per ton per mile (cents)
Before the invention of the steamboat, most river transportation was downstream.

Navigation upstream was done by rafts and flatboats (keelboats). They were very slow as they had to be pulled or poled. At most they could travel 15 miles per day.
Robert Fulton

Fulton constructed his first steamboat in France in 1803.

In the U.S. in 1807, he built the steamboat Clermont.

The Clermont was the first steamboat used as a regularly scheduled commercial transport ship.

Robert Fulton patented his steamboat design and constructed several more, including the world’s first steam warship in 1814.

The New York state legislature gave Fulton the sole right (monopoly) to run steamboats in New York. This led to the famous 1824 Supreme Court case, Gibbons v. Ogden, which struck down Fulton’s monopoly and made it illegal for state governments to regulate interstate commerce.
Clermont, 1807

The first trip of the "CLERMONT."
Another view of the Clermont’s first voyage
In 1811, Fulton and several partners built the *New Orleans*, the first steamboat to steam on the Mississippi River.

In 1814, Henry Shreve designed a flat-bottom steamboat, the *Enterprise*, for the shallow waters of the western rivers.

The *Enterprise* was the first steamboat to make a return trip from New Orleans to Louisville, Kentucky.

Within a few years there were hundreds of steamboats carrying cargo and passengers up and down all navigable western rivers.
Early steamboats at river ports
Steamboat horns: click

Dun in Mobile

7026. MISSISSIPPI RIVER PACKET WITH LARGE LOAD OF COTTON.

Well, good buy! Here's my ferry.
Steamboat race between the *Memphis* and the *James Howard* in 1877.
“THE GREAT RACE ON THE MISSISSIPPI
The Stevens family were inventors who designed successful steamboats, including the *Phoenix*, the first steamboat to travel on the ocean.
Growth in the number of steamboats on western rivers, 1811 to 1860

# of steamboats

1811
1820
1830
1840
1850
1860

#### 1811

#### 1820

#### 1830

#### 1840

#### 1850

#### 1860

# of steamboats
Railroads were the most important factor for economic growth in the second half of the 19th century. The foundation for this was laid in the antebellum period (before the Civil War, 1861-1865) when early railroads tended to duplicate existing steamboat and canal routes.

Railroads had several advantages over steam and canal boats:

First was their speed. Early freight trains could run between 10 and 30 miles per hour, much faster than water transportation in canals or steamboats.

Second, they could travel over manmade (straight) routes rather than having to follow natural waterways. This resulted in shorter travel time. They could be built in rugged terrain and cost only a fraction of the cost of canal construction.

Third, they could travel year round in any climate and were not affected by freezing temperatures.
Railroad construction: 1830-1860
The two large steam coaches are named "The Infernal Defiance -- From Yarmouth to London" and "The Dreadful Vengeance -- Colchester, London."

On the rear of the coach in front is a banner proclaiming "Warranted free from Damp." The small delivery wagon has "Bread served Hot" on its side, and the service station proclaims "Coals Sold Here: only 4s. 6d. per Pound(?)."

As Paul Johnson has documented in his book The Birth of the Modern, the early British railroad companies were at pains to avoid any possible competition from free-running steam coaches (which may not have been too practical anyway...).
Richard Trevithick built the first working steam locomotive

Trevithick’s steam locomotive as an attraction for paying customers in London's Euston Square: watercolor by Rowlandson, 1809.
The Englishman George Stephenson is credited with designing the *Blucher*, one of the first steam locomotives, in 1814.

In 1821, he and his son Robert began construction on the *Stockton and Darlington Railway*, which opened in 1825.

The engine, named *Locomotion #1*, hauled an 80-ton load reaching a speed of 24 miles per hour.
Peter Cooper

Peter Cooper was an American inventor, politician, industrialist, and philanthropist.

He built the first steam-powered railroad locomotive in the U.S.

His locomotive was named *Tom Thumb* and was used successfully on the Baltimore and Ohio Railroad starting in 1830.
The first steam engine to operate on a commercial track in the United States, the *Tom Thumb* became famous for its race against a horse-drawn car on August 25, 1830, from Ellicott’s Mill to Baltimore. The horse won the race when the engine broke down.
Peter Cooper's steam engine, *Tom Thumb*
Jethro Woods
Cyrus McCormick
John Deere
Samuel Colt
Samuel F. B. Morse
Thomas Davenport
Charles Goodyear
Richard M. Hoe
Elias Howe
Isaac Singer
Elisha Otis
Edwin Drake
Cyrus Fields
Cigar box featuring "Famous American Inventors."
From left to right: Eli Whitney (cotton gin), Robert Fulton (steamboat), Thomas Edison (light bulb), Cyrus McCormick (mechanical reaper), Richard Hoe (automatic printing press).
Jethro Woods

His 1819 plough was made of cast iron, but in three parts, so that a broken part might be replaced without purchasing an entire plough. This principle of standardization soon became widespread.
In 1831, at the age of 22, McCormick invented the first successful mechanical reaper, which later led to the harvesting machine industry. McCormick ushered in a new era of agricultural mechanization. Now fewer farmers could feed more people. This made it possible for millions of people to leave farms for jobs and careers in the new cities and factories.
Five thousand years of reaping (harvesting): 3000 BCE to 1831 CE
Cyrus McCormick

He is known as the “Father of Modern Agriculture.”

Building on the work of his father, McCormick invented a mechanical horse-drawn reaper in 1831.

Reaping is the process of harvesting a crop. It includes cutting grain or pulses (seeds or legumes) using a scythe, sickle or reaping machine.

The mechanical reaper increased the farmer’s yield by tenfold and allowed farmers to greatly expand land under cultivation.

McCormick, after a slow start, became wealthy producing reapers and other mechanical farm implements in his Chicago factories.

His reaper played an important role in opening up western lands to farming.
Deere knew that Jethro Woods’ iron plows were not working well in the tough western prairie soil where farmers were now moving.

In 1837, he invented a steel plow that easily moved through tough western soils.

His plows were a commercial success. The company he founded is still a major player in the agricultural machinery industry.

John Deere plows moved across the continent in wagon trains, helping settle the far west and turn it into a rich agricultural farming country.
John Deere invented a steel plow that could cut through land that in the past could not be cultivated with iron plows. He went on to build a large agricultural implement business.

John Deere’s 1859 factory

First steel plow
Samuel Colt

Samuel Colt constructed the first practicable multi-shot revolving-breech-loading pistol in 1836. With investors he began a company, but they were not successful until the outbreak of the Mexican War in 1846. The war brought orders from the government for thousands of Colt revolvers. The new company, *Colt’s Patent Fire-Arms Manufacturing*, was a success, and in the early 1850s Colt built the world’s largest arms factory. Colt’s pistols, before the 1860s, did not fire bullets; they were cap and ball weapons.
Colt 1847 *Walker* pistol used by Texas Rangers

18-year-old Samuel Colt first experimented with pistol design while on a long sea voyage with missionaries in 1832.
In 1834-35, Thomas Davenport, with the aid of his wife Emily, invented the first electric motor.

In 1837 he received the first patent for a machine run by electricity.

His electric motor was used to run lathes, drills and a printing press.

His invention was ahead of its time; electricity as a power source would not come into play until the later part of the 19th century.
Samuel F.B. Morse: Inventor of the telegraph

Morse, an artist, inventor and college professor, demonstrated in 1835 that signals could be transmitted by wire using electricity.

He received $30,000 ($800,000 in 2005 dollars) in 1843 from the government to build an experimental telegraph line between Baltimore and Washington D.C.

In 1844 the first message was sent between the two cities. In the following years, Morse and his partners expanded their lines to several other cities.

Soon several small telegraph companies were operating.

In 1861 the Western Union company built the first transcontinental telegraph system.

Until the invention of the telephone in 1877, the telegraph was the only long-distance method of communication.
Painting by Morse of his daughter Susan in 1837

Samuel F.B. Morse
In 1835, Samuel Morse proved that signals could be transmitted by wire. He invented the Morse Code which used dots and dashes to transmit messages. In 1838 Congress funded construction of an experimental telegraph line from Washington to Baltimore, a distance of 40 miles. The first official message, "What hath God wrought?" opened the completed line on May 24, 1844.
“Another Texas Message by Morse’s magnetic telegraph”: 1844
The original telegraph receiver used in Baltimore to receive the first telegraph message on May 24, 1844.

First telegraphic message: “What hath God wrought?”

Early telegraph key, 1844-1845
Major effects of the Industrial Revolution

- Population growth
- New manufacturing technology
- Improvements in transportation
- New types of business organizations
- Westward movement
- Urbanization
- Market revolution