

Industrialization

From Farm to Factories: Urbanization

Context: What was the situation in England with the open field system?

Problem

How do you maximize the land around you?

→

Solution

How do you increase your crops on the land?

→

Inventor:

Invention

Purpose

How do you keep the soil fertile and prevent the depletion of its nutrients?

→

Inventor:

Invention

Purpose

Where do farmers go after being displaced by the enclosure movement and better farming techniques?

→

1. Enclosure Movement



It is hard to believe that the most remarkable change in the history of mankind took place within the lifespan of a single generation. But the series of social, scientific, and economic changes which we call the Industrial Revolution did actually take place within the space of about seventy years.

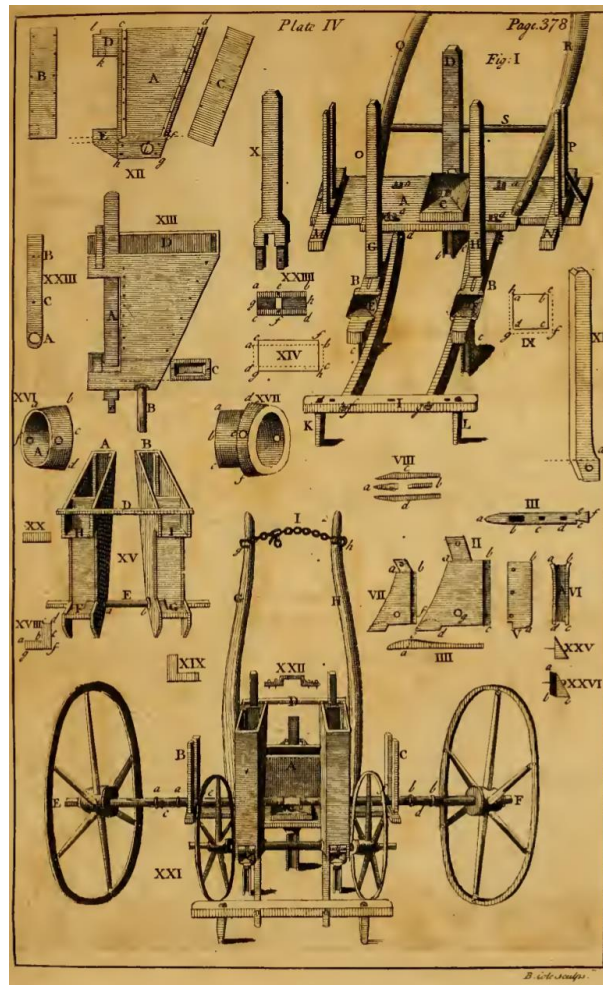
It is difficult to pinpoint an exact date on which this revolution began. All revolutions take a very long time to come into force and the seeds of change may be sown long before they take root and finally burst through the soil. But we can say that Britain's transformation from an agricultural country into an industrial nation began in about the year 1760.

Before that date, eighty per cent of Britain's population lived on the land. The purpose of farming had been simply to provide enough food for a man's family, and to make a little money by selling his surplus produce in the nearby town. Life for the farm labourer was tough, but so long as his primitive farming methods kept himself and the rest of society from food shortage, the system was an adequate one. For the rich landowner, on the other hand, the open-field system was a wasteful one. Throughout Britain the wealthy landed gentry began to realise that by using the improved, scientific, agricultural methods invented by such men as Jethro Tull, Lord Townshend and Thomas Coke, they could make their land much more profitable. But this improved agriculture could be carried out only at the expense of the open field system – and, at the expense of the farm labourer's livelihood.

By a series of Acts of Parliament land all over Britain was divided into enclosures which radically changed the face of the whole countryside. The pretty patchwork of fields enclosed by hedges and trees which make up the English landscape that we know today meant hardship and poverty to the farm labourer, and high profits to the already wealthy landowner. For the enclosure system meant that a good deal of common land from which most people derived their livelihood was taken away. The combination of the Enclosure Acts and the improved methods in agriculture which we call the Agrarian Revolution had the effect of making the rich richer and the poor poorer.

The consequences of the agrarian revolution were to have a startling effect on the entire social system of Britain. The yeoman had become a landless labourer, drifting to the towns for employment in the new factories to save himself from starvation. To many of these men the 'dark satanic mills' were preferable to hunger and misery in 'England's green and pleasant land'. But when they arrived at the new towns they must have thought that they had only exchanged one evil for another. Having escaped from the awful consequences of one revolution, they found themselves facing another revolution – the most remarkable one of all time.

2. Seed Drill



Since earliest times seeds had always been sown by hand. People who worked on the land would walk over the fields randomly scattering handfuls of grain. Jethro Tull invented a machine which greatly helped to increase the harvest yield by planting seeds in straight lines.

Jethro Tull was born in Basildon, Berkshire in 1674. He did not start out as an agricultural engineer. He studied law and graduated from Oxford University in 1699. Although he was admitted to the bar in the same year, he never practised law. Tull was far more interested in the farming methods employed on his land, which he called Prosperous Farm.

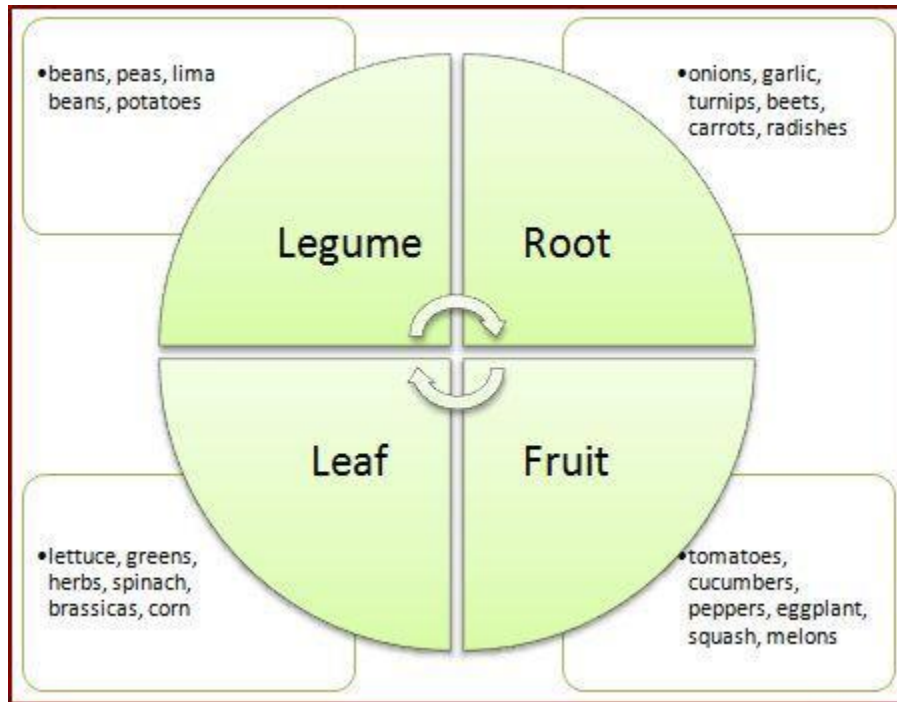
Tull travelled throughout Europe to study new farming techniques. On his return to Prosperous Farm in 1701, he developed a horse-drawn mechanical Seed Drill. The Seed Drill not only planted seeds at regular intervals but also planted them at the right depth and covered them with earth. Because the seed drill planted seeds in straight lines, a mechanical horse-drawn hoe, which Tull also invented, could be used to remove weeds from between the lines of crop plants.

Tull advocated the importance of pulverising (crumbling) the soil so that air and moisture could reach the roots of the crop plants. His horse-drawn hoe was able to do this. He also emphasised the importance of manure and of tilling the soil during the growing season.

At the time, Tull's ideas came under attack, mainly because they were new. His Seed Drill was not immediately popular in England, although it was quickly adopted by the New England colonists across the Atlantic.

In 1731, Tull wrote a book called "Horse-houghing (hoeing) Husbandry" which he revised in 1733. Although his Seed Drill was improved in 1782 by adding gears to the distribution mechanism, the rotary mechanism of the drill provided the foundation for all future sowing technology.

3. Crop Rotation



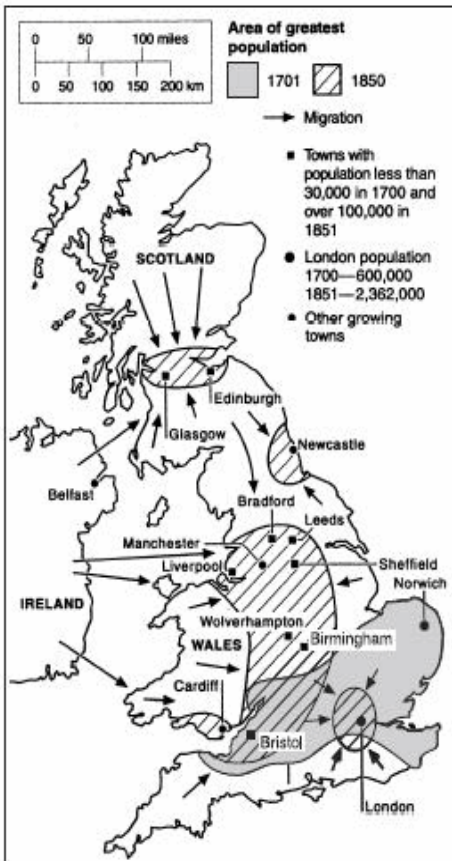
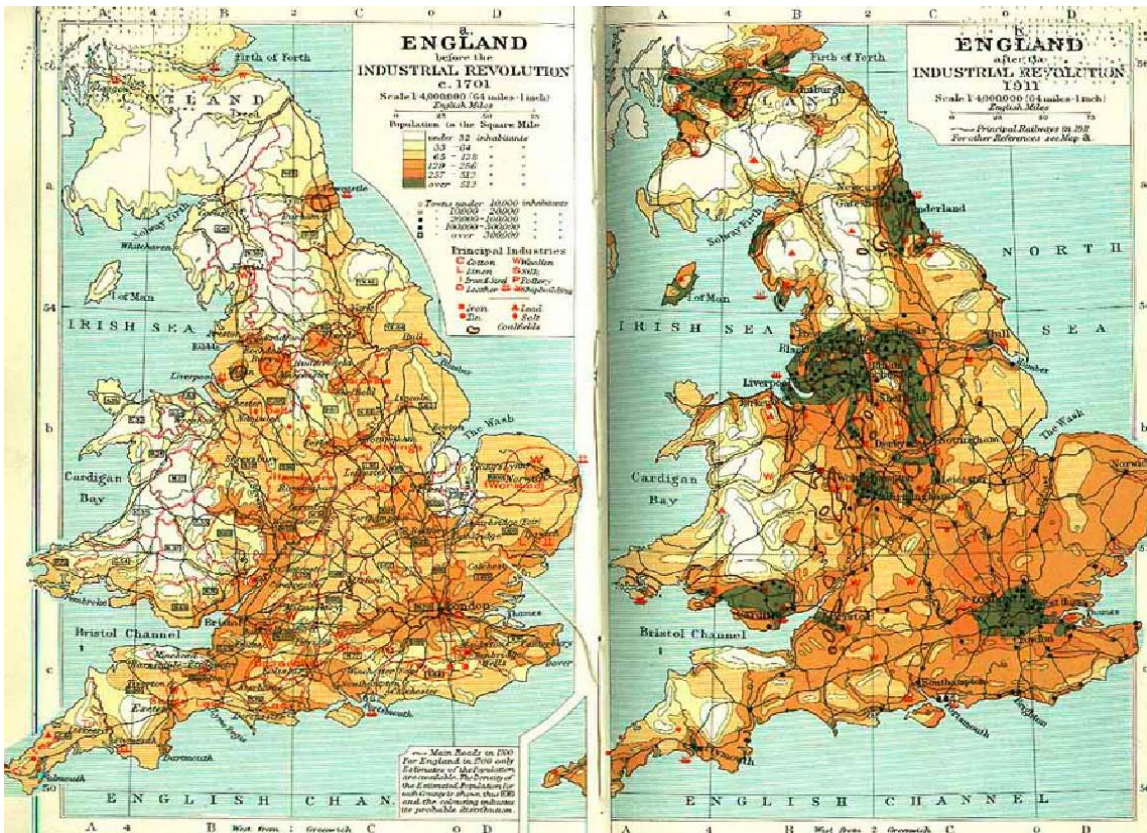
During that period of discovery and innovation in Britain known as the Agricultural Revolution, there were many men of learning who emerged to champion scientific methods of farming, but none with a nickname so evocative as "Turnip" Townshend.

"Turnip" was actually born Charles Townshend in 1674. At the age of twelve he succeeded to the family title and became 2nd Viscount Townshend. He had an illustrious career as a Whig politician under George I, becoming Secretary of State, and for a while, directing Britain's foreign policy along with Robert Walpole, his brother-in-law.

When Townshend was forced out of politics because a difference of opinion with Walpole, he retired to his estate, Raynham, in West Norfolk. There, Townshend began experimenting with new agricultural techniques, most importantly crop rotation. If the same crop is grown over and over again on the same plot of land—as had been the practice for millennia in Britain—the land eventually loses fertility and harvests decline. The only way to prevent this was to let the land lie fallow for a season or two.

Townshend discovered—or merely popularized, there is some debate—that if crops were grown in rotation, the land could be kept in production with no loss of fertility. To do this, the land was divided into four fields and in each was grown in succession: wheat, clover, barley and turnips. The clover and turnips renewed the soil when grown after wheat or barley. Indeed, we now know that clover is a nitrogen fixing plant—one of several crops that puts nitrogen back into the soil. Turnips and clover were also fodder crops. When the animals were let into the field to graze, their droppings fertilized the land.

4. Urbanization



Source: World History on File, 1999

Industrialization

From Farm to Factories: Urbanization

Context: What was the situation in England with the open field system?

Before the industrial revolution, 80% of Britain lived on the land. Farmers simply tried to survive and have little extra to sell at the market. They depended on common land for their survival.

Problem

How do you maximize the land around you?

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Solution

Wealthy landowners felt the open land was wasteful and through a series of Parliamentary act took it. These Enclosure Acts increased the land of the wealthy that they experimented with new methods. Poor farmers could no longer survive though.



How do you increase your crops on the land?

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Inventor: Jethro Tull

Invention: Seed Drill was a machine that planted seed in straight lines at regular intervals.

Purpose:

It made seeding more efficient and weeding easier.



How do you keep the soil fertile and prevent the depletion of its nutrients?

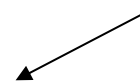
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Inventor: Charles Townsend

Invention: Crop Rotation divided land into four areas and rotated wheat clover, barley and turnips. Clover and turnips renewed the soil while also providing food for livestock.

Purpose:

You had greater food production without depleting the soils nutrients.



Where do farmers go after being displaced by the enclosure movement and better farming techniques?

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Less farming labor was needed with the changes in agriculture. Therefore many people were without land and work, which led to a mass migration of people into cities in search of work.

From Hand to Machines: Increasing productivity

Context

Problem

How do you produce more cloth for clothing?

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Solution

Inventor:
Invention:
Purpose:

How do you match the demand for cloth with the greater need for thread?

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1. Inventor:
Invention:
Purpose:
2. Inventor:
Invention:
Purpose:
3. Inventor:
Invention:
Purpose:

What do you do with the surplus of thread now?

→

Inventor:
Invention:
Purpose:

How do you get more cotton for your factories?

→

How do you increase the cotton production?

→

Inventor:
Invention:
Purpose:

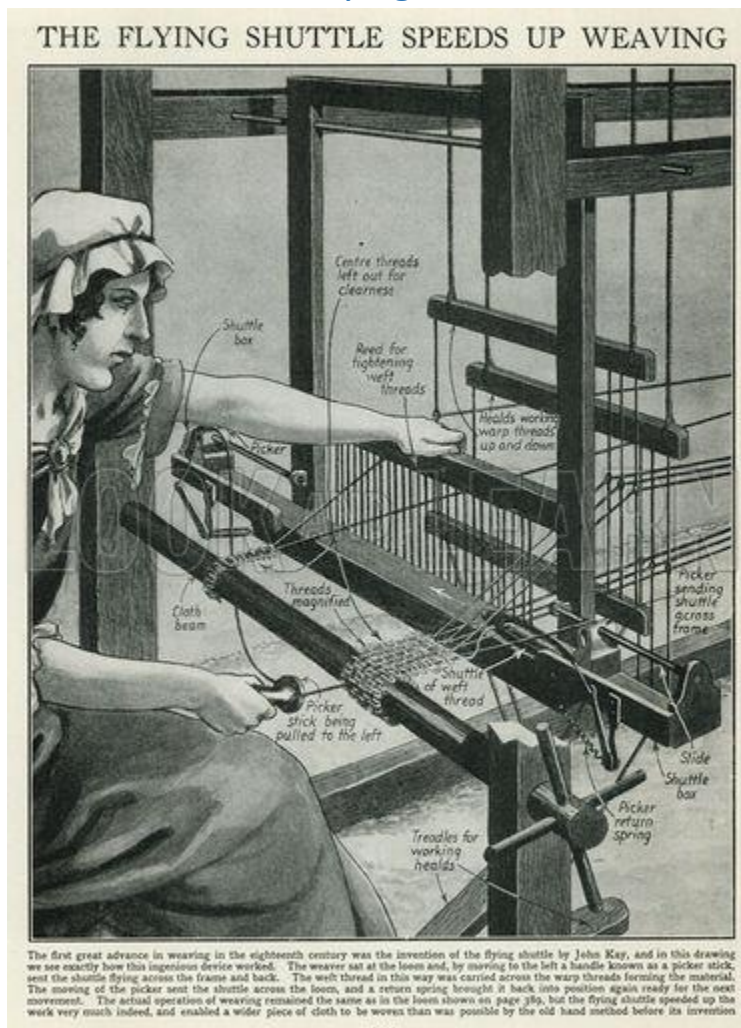
How do you meet the demand for cotton?

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How do you improve transportation between producers of raw materials and factories?

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1. Flying Shuttle

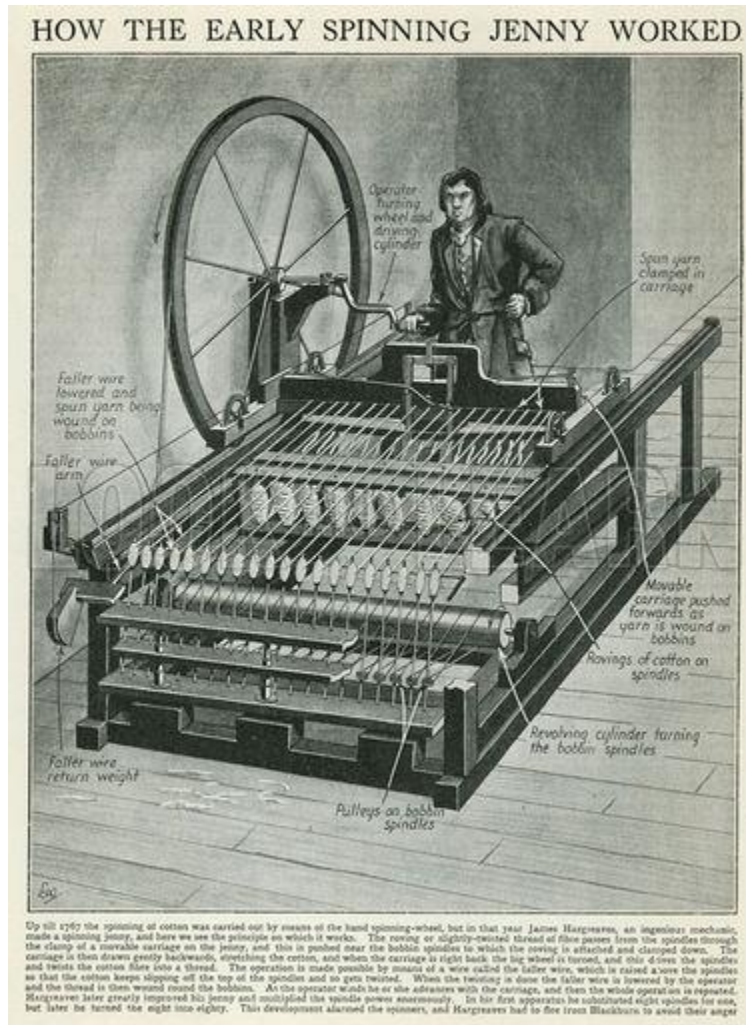


In 1733, John Kay invented the flying shuttle, a key contribution to the Industrial Revolution. The flying shuttle was an improvement to looms that enabled weavers to weave faster. The original shuttle contained a bobbin on to which the weft (weaving term for the crossways yarn) yarn was wound.

It was normally pushed from one side of the warp (weaving term for the series of yarns that extended lengthways in a loom) to the other side by hand. Large looms needed two weavers to throw the shuttle. The flying shuttle was thrown by a lever that could be operated by one weaver. The shuttle was able to do the work of two people even more quickly.

<http://inventors.about.com/od/famousinventions/fl/Flying-Shuttle-John-Kay.htm>

2. Spinning Jenny



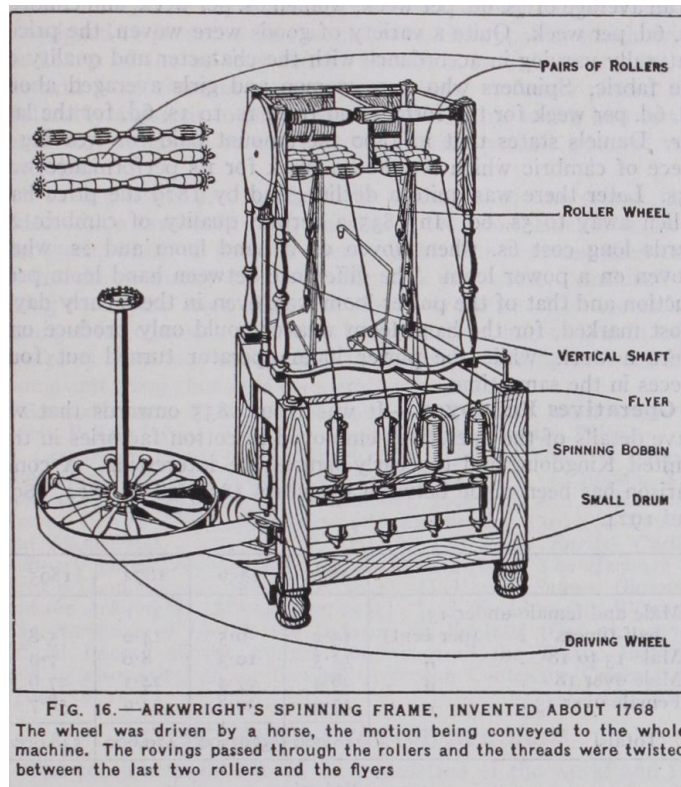
The original spinning jenny used eight spindles instead of the one found on the spinning wheel. A single wheel on the spinning jenny controlled eight spindles, which created a weave using eight threads spun from a corresponding set of rovings. Later models had up to one-hundred and twenty spindles.

James Hargreaves made a number of spinning jennies and started to sell a few of them in the area. However, since each machine was capable of doing the work of eight people, other spinners were angry about the competition. In 1768, a group of spinners broke into Hargreaves' house and destroyed his machines to prevent the machines from taking work away from them.

While James Hargreaves' invention did in fact decrease the need for labor, they also saved money. The only drawback was that his machine produced thread that was too coarse to be used for warp threads (the weaving term for the series of yarns that extended lengthways in a loom) and could only produce weft threads (the weaving term for the crossways yarn).

<http://inventors.about.com/od/famousinventions/fl/Who-Invented-the-Spinning-Jenny.htm>

3. Spinning Frame

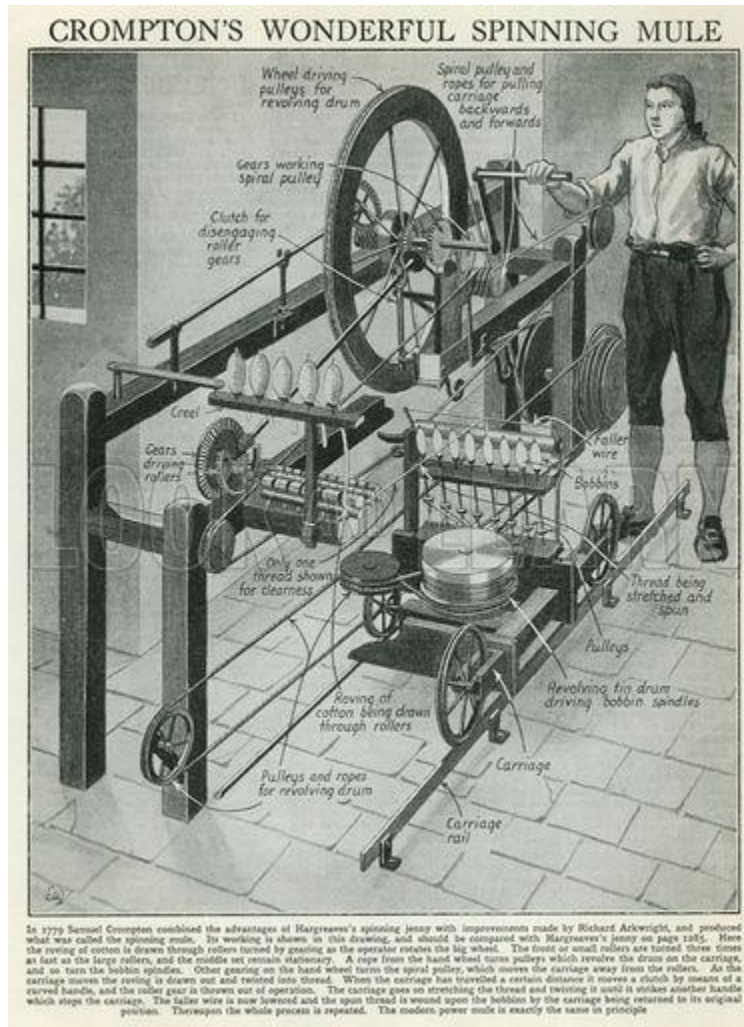


In 1769 Arkwright patented the invention that made him rich, and his country an economic powerhouse: The spinning frame. The spinning frame was a device that could produce stronger threads for yarns. The first models were powered by waterwheels so the device came to be known as the water frame.

It was the first powered, automatic, and continuous textile machine and enabled the move away from small home manufacturing towards factory production, kickstarting the Industrial Revolution.

<http://inventors.about.com/od/famousinventors/fl/Richard-Arkwright-and-the-Water-Frame.htm>

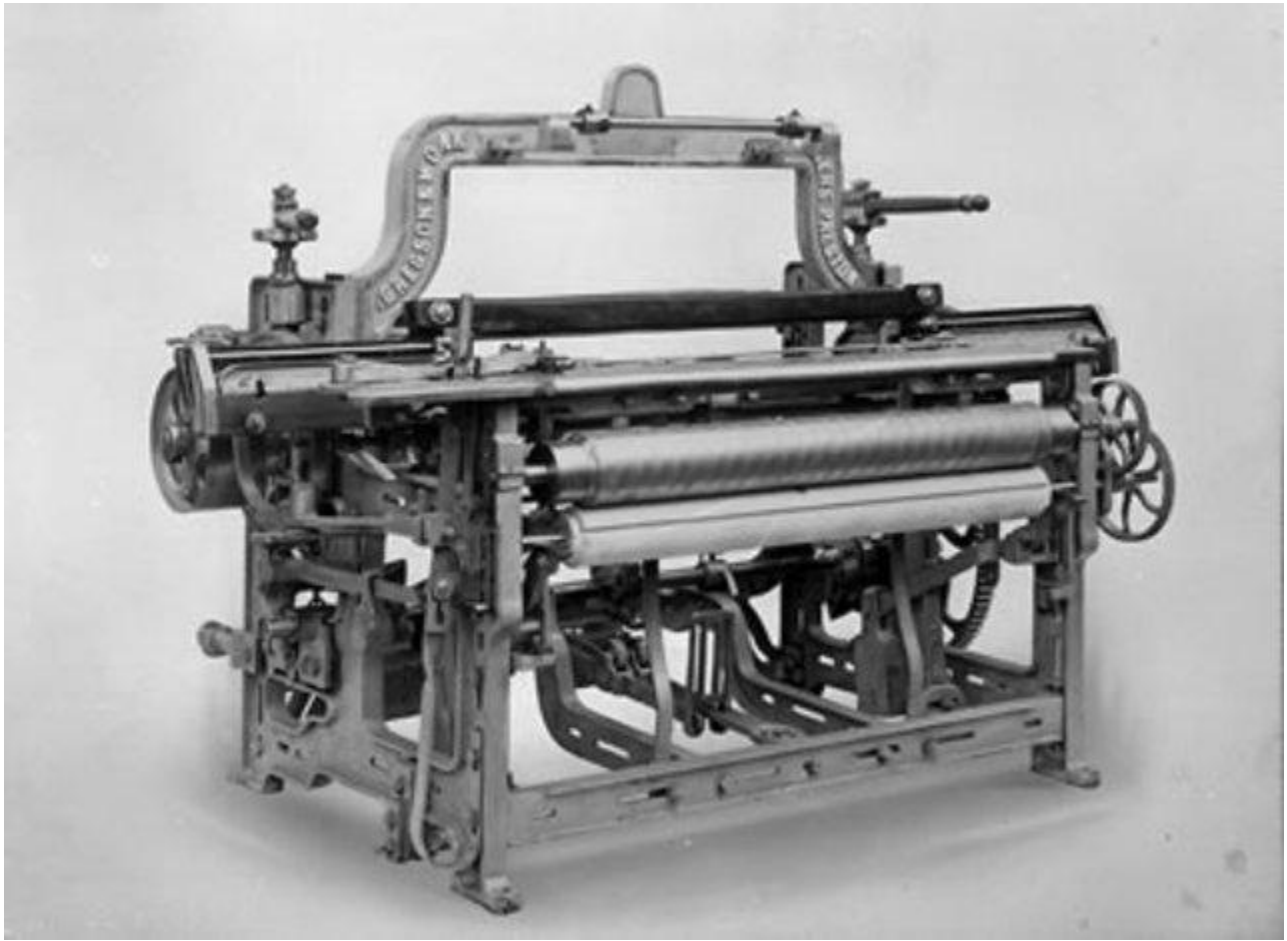
4. Spinning Mule



In 1779, Samuel Crompton invented the spinning mule that combined the moving carriage of the spinning jenny with the rollers of the water frame. The spinning mule gave the spinner great control over the weaving process, many different types of yarn could be produced.

<http://inventors.about.com/od/cstartinventors/a/Spinning-Mule.htm>

5. Power loom



The first power loom, a mechanized loom powered by a drive shaft, was designed in 1784 by Edmund Cartwright and first built in 1785. It was refined over the next 47 years until a design by Kenworthy and Bullough made the operation completely automatic (the Lancashire Loom).

The power loom reduced demand for skilled handweavers, initially causing reduced wages and unemployment. Protests followed its introduction. For example, in 1816 two thousand rioting Calton weavers tried to destroy power loom mills, and stoned the workers. A darker side of the power loom's impact was the growth of employment of children in power loom mills.

<http://historymesh.com/object/power-loom/?story=textiles>

6. Cotton Imports to England



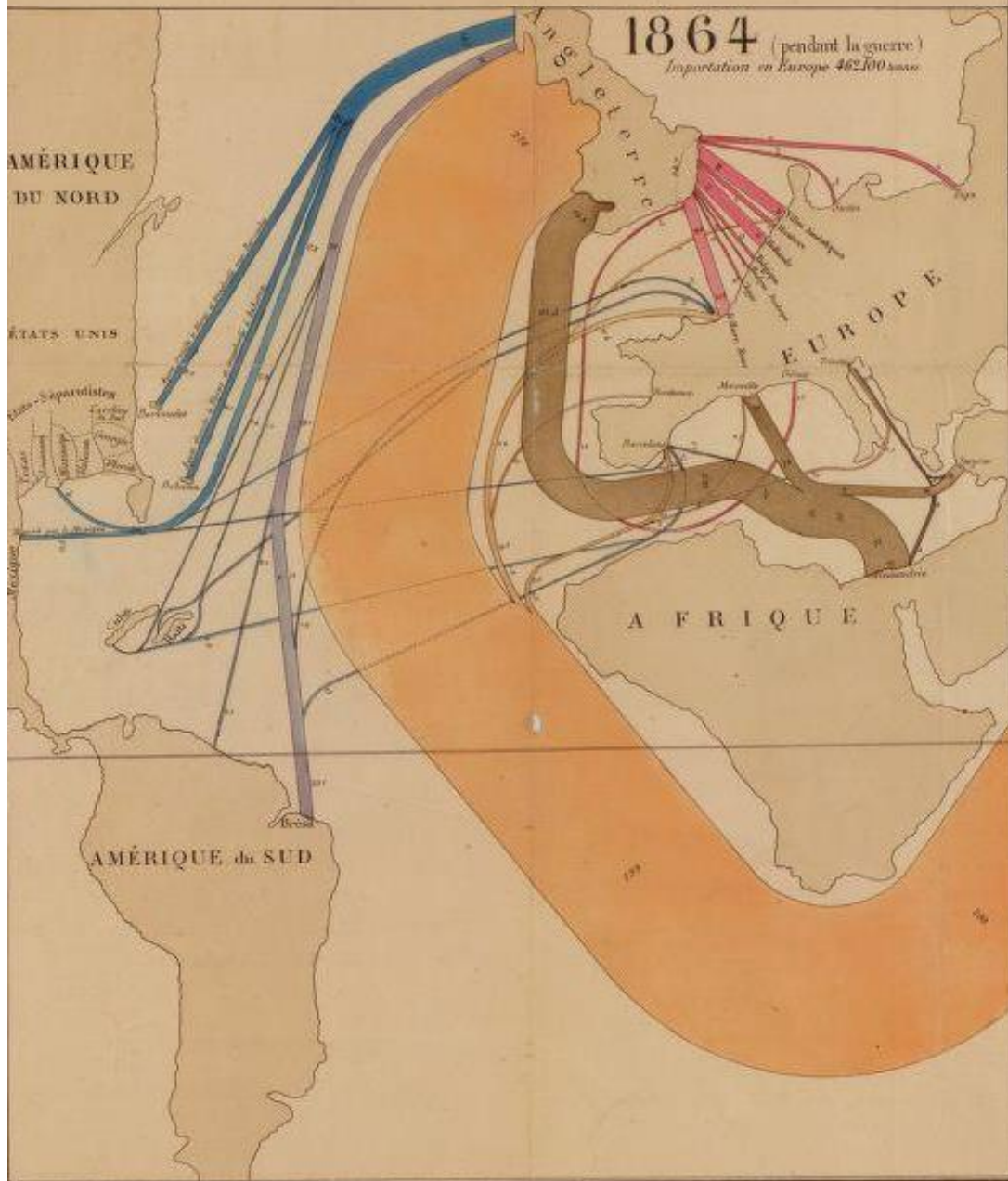
CARTE figurative et approximative des quantités de **COTON BRUT** importées en Europe
en 1858 en 1864 et en 1865,

Dressée par M^r MINARD, Inspecteur Général des Ponts et Chaussées en retraite.
Paris, le 14 Mai 1866.

Les tonnages de coton transportés sont représentés par les largeurs des axes colorés à raison d'un millimètre pour cinq mille tonnes, de plus de plus exprimés par les nombres écrits en travers des axes et dont l'unité est mille tonnes.

Les Cartes ont été dressées sur les Documents des Douanes Françaises, Anglaises, Belges, Hollandaises, Italiennes, Autrichiennes, Le Dictionnaire du Commerce, le Trade of cotton de M. J. A. Mann, le cotton circular et la publication Statisticks of Liverpool, le Merchant's Magazine de Newyork, l'économist de Londres, la circulaire Carpi d'Alexandrie etc.

Observation: Les importations sont un peu plus fortes que celles de la Carte parce qu'on n'a pas tenu compte des Douanes devant en classer les trois parties répétitives de toute provenance, je n'ai eu à laquelle les rapporter.



De l'importation du Coton en 1865. — La question commerciale de coton entre deux des phases nouvelles depuis que la guerre civile des Etats-Unis a Amérique a cessé.

Toutes les parties de l'Asie qui envoient du coton en Europe en ont exporté plus en 1865 qu'en 1864 à l'exception de l'Inde et de la Chine, même des contrées méridionales de l'Europe ont exporté plus de coton qu'ordinairement et on est surpris plus de six mille tonnes à Marseille et à Trieste. Il y a donc aujourd'hui un surcroît d'activité générale pour la production de cette plante textile.

Toutes fois l'importation de 1865 est encore d'un sixième au-dessus de ce qu'elle était avant la guerre.

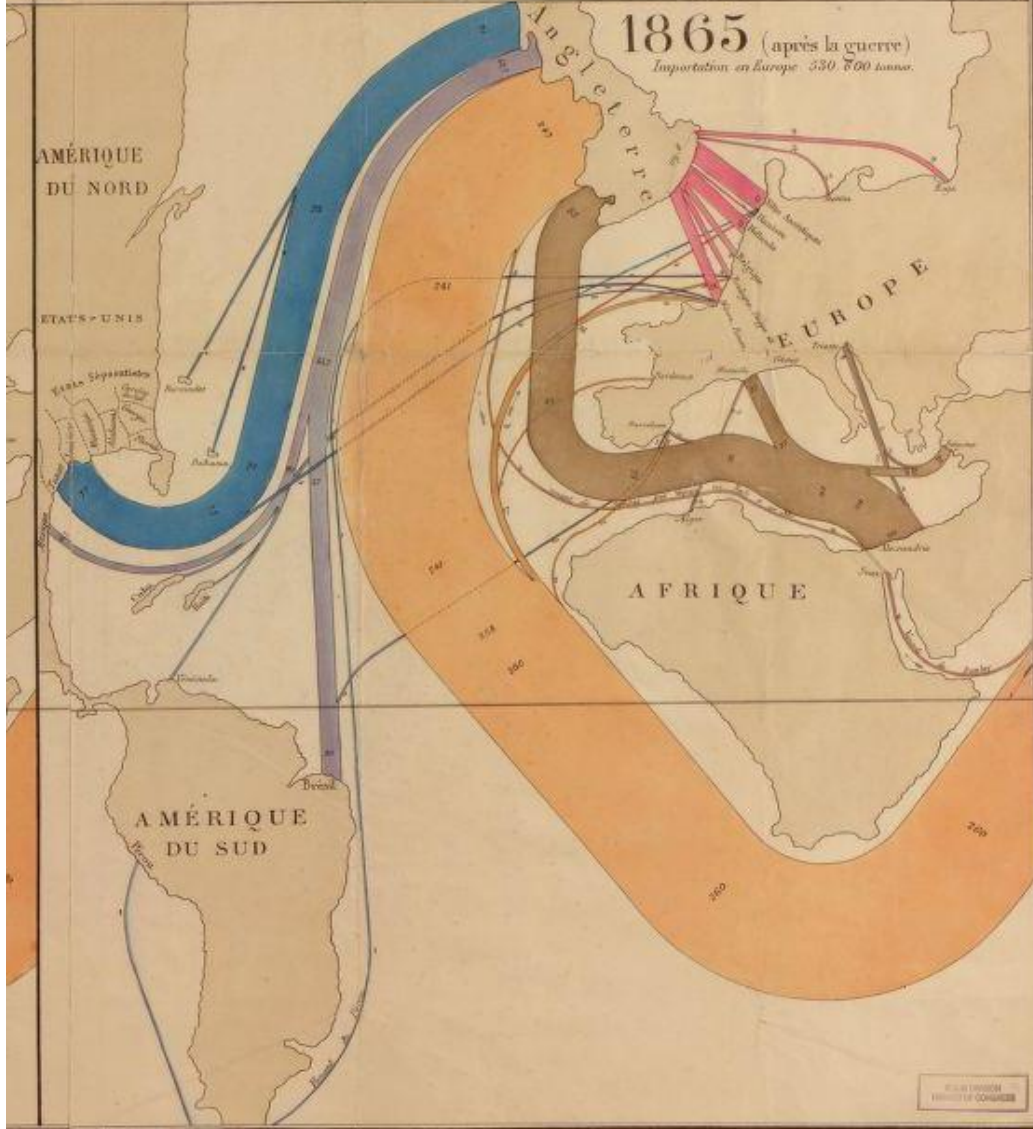
Le même des importations diverses, on fait remarquable à lui. Du coton sans rapacité aujourd'hui de Bombay à Liverpool par la Mer Rouge, le chemin de fer de Suez à Alexandrie, la Méditerranée et l'Osian. La vapeur est l'unique moteur des mouvements sur les rivières et sur les mers; ces transports sont indépendants de ceux de la Compagnie Néerlandaise Orientale et de la Compagnie des Messageries Impériales.

Cette voie nouvelle qui évite le Canal de l'Ethiops de Suez, sera-t-elle jamais ouverte après l'exploitation du Canal ? Indique-t-elle d'autres voies

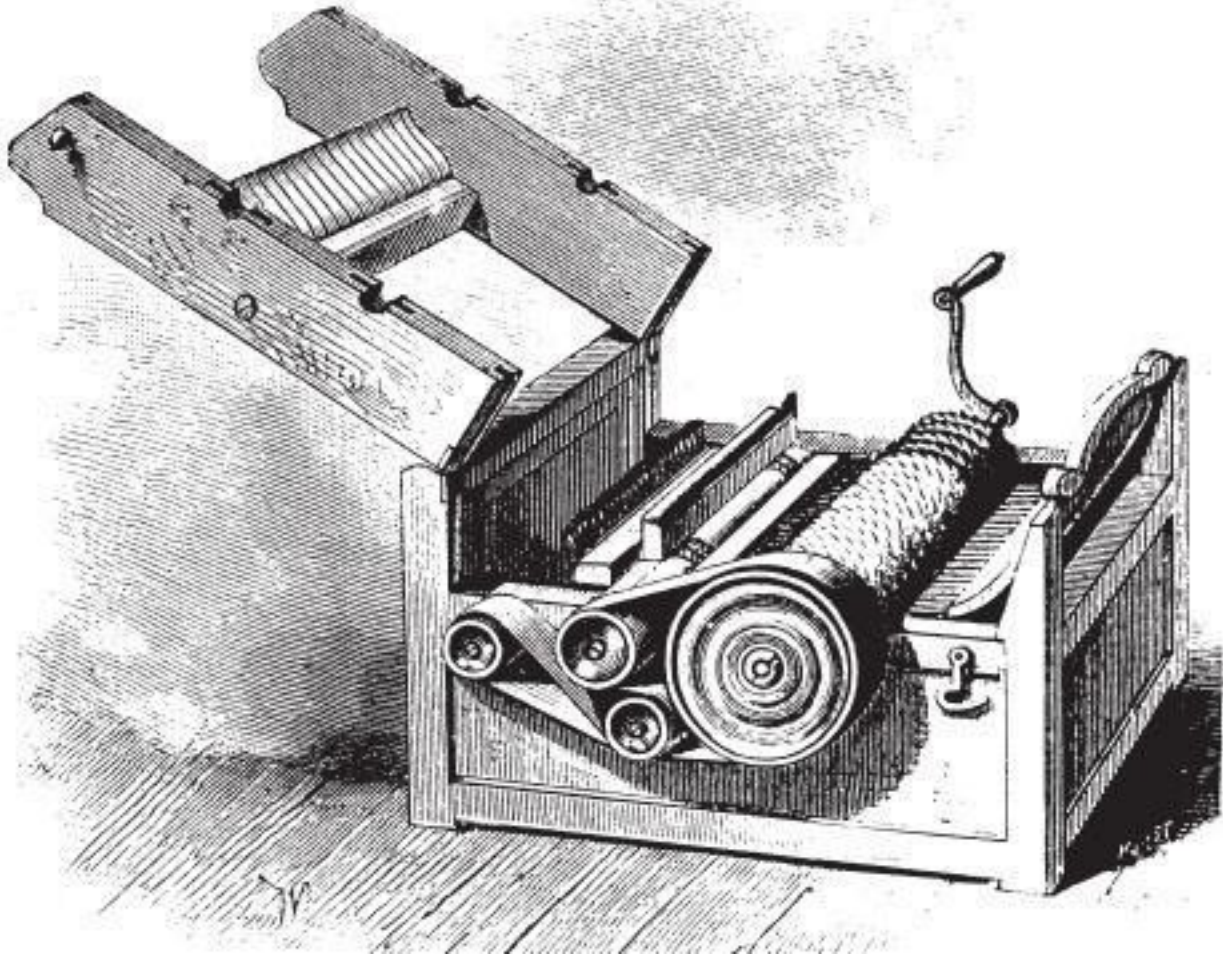
semblables pour le coton de l'Asie centrale traversant la Mer Noire et la Mer Caspienne ? C'est ce qu'on se peut dire.

On attendrait sans assistance à la lutte opposée des trois États grands producteurs de coton. L'Etat-Unis qui cherche à monopoliser le marché, mais dont le genre de succès et si contingent est également entravé par l'insécurité et l'instabilité des lignes affaiblies qu'ils ne peuvent pas être plus employées; 2° l'Espagne qui abandonne peu à peu sa culture si ancienne de filé pour celle de coton; 3° l'Inde qui devient une nouvelle production aux plantations de coton, surtout chez elle de temps immémorables, voudra à toute force se payer des services nouveaux qu'elle a faits en ouvrant de voies de terre, d'eau et de fer pour aller ses districts éloignés avec ses ports maritimes.

Voilà les grands foyers producteurs, quant aux débouchés commerciaux, qui se résument propre à l'Angleterre, il n'est pas probable que ce pays étende dans le même sens à l'avenir tout d'une seule source la matière première indispensable à la vie de quatre millions de ses habitants. Sans doute il entretient entre les producteurs comme une concurrence si utile pour lui et pour l'Europe, et nous pouvons espérer de la voir continuer longtemps.



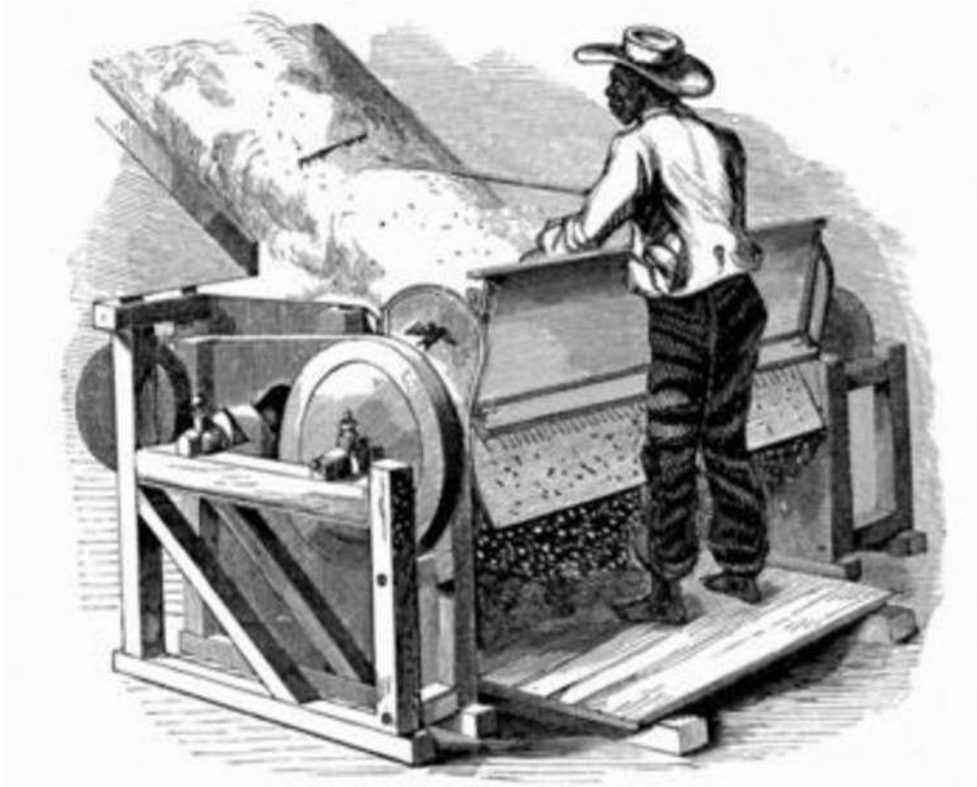
7. Cotton Gin



In 1794, U.S.-born inventor Eli Whitney (1765-1825) patented the cotton gin, a machine that revolutionized the production of cotton by greatly speeding up the process of removing seeds from cotton fiber. By the mid-19th century, cotton had become America's leading export. Despite its success, the gin made little money for Whitney due to patent-infringement issues. Also, his invention offered Southern planters a justification to maintain and expand slavery even as a growing number of Americans supported its abolition.

<http://www.history.com/topics/inventions/cotton-gin-and-eli-whitney>

8. Slavery



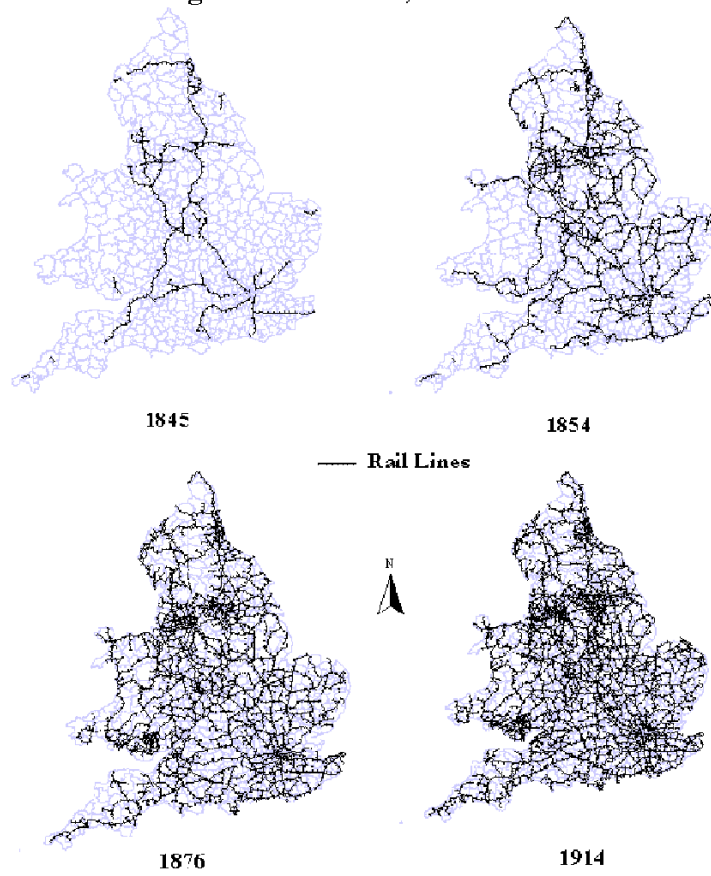
Although there was some hope immediately after the American Revolution that the ideals of independence and equality would extend to the black American population, this hope died with the invention of the cotton gin in 1793. With the gin (short for engine), raw cotton could be quickly cleaned; Suddenly cotton became a profitable crop, transforming the southern economy and changing the dynamics of slavery. The first federal census of 1790 counted 697,897 slaves; by 1810, there were 1.2 million slaves, a 70 percent increase.

Slavery spread from the seaboard to some of the new western territories and states as new cotton fields were planted, and by 1830 it thrived in more than half the continent. Within 10 years after the cotton gin was put into use, the value of the total United States crop leaped from \$150,000 to more than \$8 million. This success of this plantation crop made it much more difficult for slaves to purchase their freedom or obtain it through the good will of their masters. Cotton became the foundation for the developing textile industry in New England, spurring the industrial revolution which transformed America in the 19th century.

<http://www.pbs.org/wgbh/aia/part3/3narr6.html>

9. Railroads

The Extension of the Railway System in England and Wales, 1845-1914



Waterways in England

