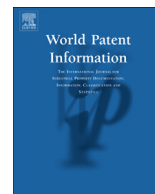




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Textile patents and the GB Industrial Revolution



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ABSTRACT

The GB Industrial Revolution (c. 1760–1850) resulted in a vast expansion in industrial activity of which one of the most lucrative was textile production, especially cotton which is rather surprising as the raw cotton was imported vast distances. How this came about is discussed with reference to the crucial patents.

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Textiles Before the great population explosion after 1750 GB's sheep population greatly exceeded the humans and the country was famous for its high quality wool which was exported to the European continent as far back as Roman times. In the Mediaeval period wool was GB's main export, especially to Flanders where the textile industry was established by the 10th century and the most sophisticated production methods were used. By the 1300's Flanders had become extremely wealthy through textiles and the Duke of Burgundy instituted the *Order of the Golden Fleece* which produced the sardonic response in GB that the *fleece* was ours but the *golden* was theirs! Nevertheless wool taxes were the government's largest source of revenue and the Speaker of the Lords in the British Parliament still sits on the "woolsack" as originally commanded by King Edward 3rd (1327–1377) to emphasise this point. The GB industry, though inferior to Flanders, was a considerable source of employment in parts like Norfolk, Yorkshire and the Cotswolds but few worked in what we would call factories (at that time factory often meant a trading post), most being home workers of both sexes (often children) who frequently combined hand powered spinning/weaving cloth with agricultural occupations. Apart from water or wind powered fulling (pounding the wool in human urine, originally done by human feet!), mechanisation was rare.

Patents and Innovation Although GB patents (i.e. monopolies) go back to 1447, and were limited to technical innovation after 1624, until the reforms of 1852 obtaining a patent was a long expensive procedure with no technical search or examination. Granted patents could be expensively enforced through the courts

but the process was so uncertain that few patents were granted before 1700. The rate of technological change was also extremely slow and much of that relating to textiles was imported from Europe, the powerful trade guilds being generally reluctant to consider change anyway. When William Lee (1563–1614, a clergyman) invented the first stocking frame knitting machine in 1589 his patent application was turned down by Queen Elizabeth 1 who is alleged to have said:

Thou aimest high, Master Lee. Consider thou what the invention could do to my poor subjects. It would assuredly bring them to ruin by depriving them of employment, thus making them beggars.

Lee moved to France where he did get his patent and prospered for a while before suffering persecution as a Protestant and dying in poverty, though his invention was reintroduced in GB and formed the basis of a successful industry.

Government Legislation Home grown flax and imported silk were used for textile production while cotton from Egypt appears to have been used in Manchester as early as 1600. Cotton goods were imported from India (where the cotton textile industry probably originated) by the 1680's but their use was limited by Acts of Parliament (the Calico Acts) to protect the wool interests. Other Acts of Parliament (known as the Sumptuary Laws) attempted to force the population to wear woollen garments and the Burial in Woolen Acts 1660–1680 even insisted that the dead (apart from plague victims and the destitute) should be buried in pure English woollen shrouds with heavy fines for non-compliance, though enforcement lapsed after around 1770. As usual government regulation of this type tended to drive manufacture abroad. Thus, before the industrial revolution, GB textile production was largely wool based [6]. In 1757 John Dyer even published a 4 volume epic

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poem *The Fleece* celebrating the woollen industry.

The GB Industrial Revolution is generally considered to have started in the 1760–70 period (though had its origins much further back) and comprised a continuous increase in production of coal, iron, textiles etc. with widespread mechanisation and later the widespread use of steam power, often in modern factories. Rapid urbanisation, improved road/canal links and ultimately railways were a consequence [2]. However, introduction of labour saving machinery, although increasing employment and prosperity in the long term, often caused great hardship to hand loom home workers, and often provoked a violent reaction with rioting, machine breaking, arson and attacks on employers. At that time there was no organised police force in the modern sense and disorder could reach dangerous levels before the Army was eventually called in and savage retribution inflicted. Particularly bad outbreaks occurred around 1811 where the machine breakers operated under the pseudonym “King Lud” and thus became known as Luddites. Ever since this term has since been used to cover all anti-mechanisation moves, whether violent or not.

The Innovators were an eclectic body of men, virtually all British and often from quite humble origins. Hardly any had formal scientific training from Universities, *tinkers rather than thinkers* as later historians unkindly described them [3]. Indeed England then had only two Universities, Oxford and Cambridge, who showed little interest in science let alone technology though Scotland with 5 was rather different. Nevertheless there was widespread popular interest in new technical ideas and enthusiasts often belonged to local societies for this purpose, e.g. the famous Lunar Society of Birmingham [5]. Although a high proportion of textile workers were women very few were named as patentees. Interestingly there were 2 two very early ones: 182 of 1675 Rebecca Croxton (weaving point lace) and 235 of 1684 Mary Marshall (colouring stuff to resemble tapestry hangings). Although innovation (i.e. bringing a product to the market place) is usually the cumulative effect of numerous small technical advances by unknown people, despite the risk of telling *heroic inventor* stories, some of the key innovators are now discussed in rough chronological order.

Silk Imported silk was used in the Middle Ages for luxury products and there was clearly some silk textile production in England as legislation was passed in 1364 and 1455 to protect it from cheaper foreign imports. In 1561 Queen Elizabeth was presented with a pair of silk stockings by “*her silk woman Mrs Montague, and thenceforth she never wore cloth any more*”. Although attempts to grow silk in GB in the early 1600's failed the industry was boosted by Huguenot refugees from France, especially after 1685. Nevertheless it was financially precarious due to foreign competition, fashion changes and interruption of imports due to wars. By the end of the war in 1715 the domestic silk industry was in a dire state due to high quality cheap smuggled imports from France and Italy. 3 London silk workers called Lombe were badly affected by this and John (1693–1722), the youngest, having already worked at a failed silk mill in Derby run by Sorocold and Cotchett around 1702, went out to Leghorn Italy in 1715 and managed by bribery and deception to obtain a job in the world's most technically advanced power driven silk textile factory and, in a very dangerous but successful piece of industrial espionage, bring the whole process back to England. His brother Thomas obtained patent 422 of 1718 and built a 5 story water powered mechanised silk textile mill in Derby employing around 300 workers (on the site of the previous mill) which was very successful (he is said to have made £120000–around £12 million in 2015 prices though the mill cost £15–20000). It also had also early steam engine based on Savery's design to provide warm air to stop the silk filaments snapping. Thomas was knighted in 1727 and, when his patent expired in 1732, was given a government grant of £40000 to make models of his

machinery for public display. John died in 1720, allegedly poisoned by enraged Italians!

John Kay (1704–1779) Hand loom weavers typically dealt with the output of 4 spinners. Kay was a textile inventor with 4 patents including 542 of 1733 for the “flying shuttle” which, eventually doubled the output of a weaver thus disrupting the balance of the industry. He went into business manufacturing his shuttles but, although, launching various patent infringement actions, found it very difficult to collect royalties and often suffered threats of violence. In 1747 he went to France where he licenced his patents to the French government. His son, also called John Kay, stayed in GB and developed the “drop box” in 1760 which enabled the simultaneous use of multiple flying shuttles though he does not appear to have got a patent.

Thomas Highs/Hayes (1718–1803) tried to increase cotton thread production by using 6 spindles, failed to file a patent, and allegedly named the device the Spinning Jenny after his daughter.

James Hargreaves (1720–78) improved this by adding more spindles, filed a patent (962 of 1770) and over 20000 were in use by his death. There was considerable dispute over which of them was the real inventor. **John Wyatt** (a prolific inventor and member of the Lunar Society) and Lewis Paul had developed a machine for spinning cotton yarn and Paul went on to develop the first carding machine Wyatt had no textile patents but Paul had three (562 of 1738, 636 of 1748 and 724 of 1758). They set up a mill employing 50 people which failed in the 1740's. Wyatt was no businessman and had to be rescued by Matthew Boulton who employed him as a foreman where he was later involved with the development of the famous Watt steam engine.¹

Sir Richard Arkwright (1732–92) was the son of a tailor and started life as an apprentice barber and became a wig maker. When this trade declined he entered the textile field and patented the spinning frame (931 of 1769, closely based on machines by Kay, Wyatt and Paul) which produced a hard, medium count thread for warp which allowed production of 100% cotton cloth. Previously the Lancashire industry had produced fustian, a cloth with flax warp and cotton weft which was not as soft as cotton and more difficult to sew. This was first powered by horses but Arkwright set up a water powered factory in Cromford Derbyshire in 1771 so it became known as the water frame. One of his early backers was **Jedidiah Strutt** (1726–97) who had earlier patented (734 of 1759) an improvement to the stocking frame for producing ribbed cotton stockings (the Derby rib) and become wealthy. It is said the actual inventor was one Roper who sold the invention to Strutt for a mere £5! By 1774 Arkwright employed 600 and then filed his so called *grand patent* 1111 of 1775 which attempted to monopolise the industry. He was the first to use the patented Watt steam engine in textile production, though only for pumping water to the mill race. From 1775, a series of court cases challenged Arkwright's patents and he finally lost in 1785. In the words of Boulton he was a *Tyrant & more absolute than a Bashaw & tis thought his disappointments will kill him. If he had been a man of sense & reason he wd. not have lost his patent*. Nevertheless he was a dynamic businessman, expanded his business hugely so he dominated cotton spinning, and died a wealthy man.

Samuel Crompton (1753–1827) came from a poor background and, as a boy, used Hargreaves spinning jenny which he resolved to improve. Around 1779 he produced a so called spinning mule which spun yarn for muslin. Having no money he did not file a patent and relied on manufacturers voluntary contributions when they used it. This trusting view of human nature gained him £60

¹ **Footnote 1** World Patent Information 30 (2008) 53–58 James Watt: The Steam Engine and the commercialisation of patents Brian Spear.

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