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Fine veneers, army boots and tinfoil: New light on Marc Isambard Brunel's activities in Battersea

Colin Thom

Marc Isambard Brunel is one of the giants of early nineteenth century British engineering and of the Industrial Revolution. His most renowned works came at either end of his career: the radical block-making machinery he designed for the Royal Navy at the Portsmouth Blockmills, of 1802–5; and the Thames Tunnel, the world's first underwater tunnel, begun in 1825 but not completed and opened until 1843. Between these two great achievements his career took a less noticeable path, and although he continued to find regular employment with the government, his life for much of this period was marked by disappointment and financial insecurity.

Much of his energy went into designing improvements for all sorts of manufacturing techniques and industries, but not always with commercial success. These included three private speculations at Battersea of the early 1800s: a sawmill preparing fine veneers principally for the furniture trade; a factory making boots and shoes for Wellington's army; and another producing an unusual decorative form of tinfoil. All depended upon exceptionally fine and innovative Brunel machinery or processes and progressive production methods, and so attracted admirers. Brunel invested all his money in these enterprises, moving his family to Chelsea, just across the river, to be on hand. But his and his various partners' inability to manage the businesses effectively, coupled with rare misfortune, led eventually to his financial ruin and imprisonment for debt in 1821.

The Battersea sawmill and boot factory have been considered to varying degrees by local historians and Brunel biographers. Foremost among these is (Sir) Richard Beamish, Brunel's assistant on the Thames Tunnel, whose detailed account of the engineer's activities at this stage in his career made full use of Brunel's own diaries and journals, now apparently lost.¹

But the story of the three Battersea ventures has never been adequately brought together. A study of Brunel's personal and working relationships with his partners, and his attitude to these private initiatives, goes a long way to increasing our understanding of why so many of his ingenious business practices of this period failed to succeed. Research for the *Survey of London's* forthcoming volumes on Battersea, due for publication in 2013, has provided the opportunity for a reassessment and has uncovered some important new material, principally a sheet of Brunel plans at the National Archives that relate very closely to the Battersea sawmill. Furthermore, it is perhaps not widely known that Brunel's sawmill building survived until as recently as the late 1970s, though sadly no proper record of it seems to have been made before its demolition. Finally, correspondence between Brunel and the 2nd Earl Spencer among the Althorp manuscripts at the British Library provides fresh evidence of the origins of his army boot and shoe factory, the failure of which contributed heavily to his desperate circumstances in 1821.

Background

Brunel's sawmill at Battersea evolved from his pioneering mechanized block- and woodmills projects for the Royal Navy at Portsmouth, on which he had been engaged since 1802, and which heralded a new age of low-cost mass-production for crafts hitherto dominated by a large skilled workforce. Initially the

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sawmill scheme was only part of a highly ambitious plan of Brunel's to capitalize on the renown and significance of Portsmouth by establishing his own private block factory and sawmill to serve the merchant navy. At the time, as for much of his career, he was short of money, and still awaiting what he regarded as a fair settlement from the Admiralty.

Towards the end of 1805 and in the summer of 1806, as his involvement at Portsmouth was drawing to a close, Brunel began experimenting there with new types of circular saws, made to his designs by the engineer Henry Maudslay, who had supplied all the block-making machinery. These were large-diameter saws patented by Brunel in 1805, made up of segments of sheet steel fixed together, which could be turned by a steam-driven strap or band to cut timber fastened by clamps to a carriage mounted on rollers (Fig. 1).²

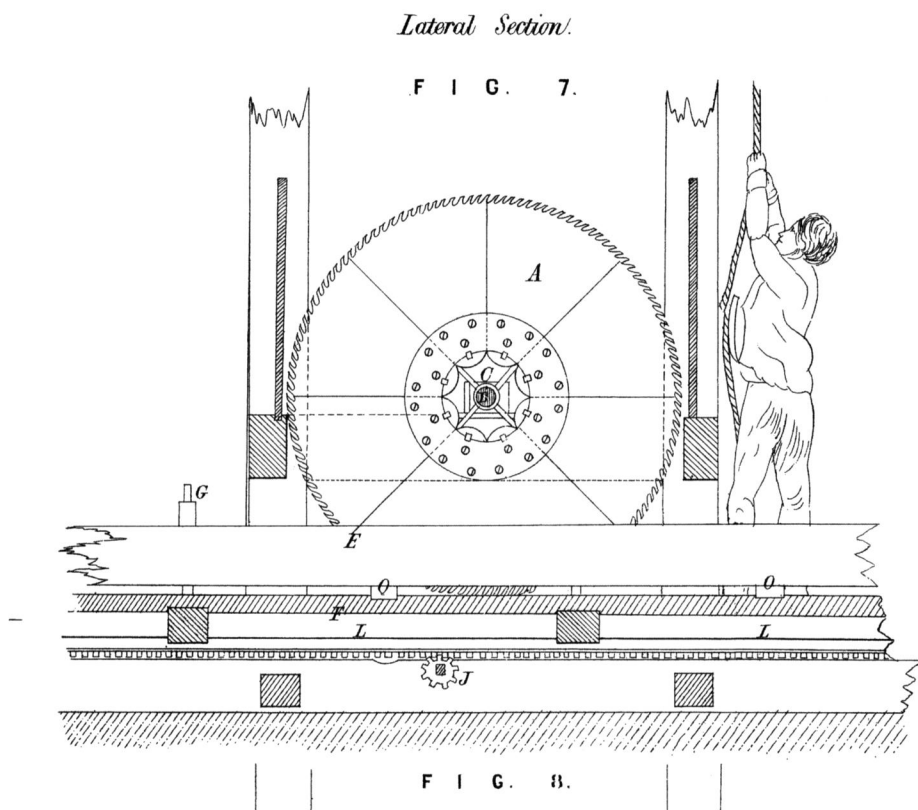


Fig. 1. Lateral section of Brunel's patent circular saw for cutting timber, of 1805. The drawing shows the saw being turned by manpower; the timber to be cut (E) is clamped to a moveable carriage (F). In Brunel's sawmills the motive power for both was usually provided by steam-engines (Patent No. 2844, 1805)

A few small circular saws had been in use at Portsmouth since the early 1800s, where they had been introduced by Sir Samuel Bentham, Inspector-General of Naval Works, and they also seem to have been

used by Messrs Taylor, the Southampton block-makers whose plant was superseded by Brunel's Portsmouth blockmills, and by George Smart, a Lambeth saw-miller. Brunel himself designed several more for preparatory work in the blockmills, for cutting and trimming logs to the basic shape required for the block-pulley shells, and also for cutting disc-shaped blanks from *lignum vitae* for making the block sheaves. It has been suggested that Brunel may have seen powered circular saws at work in America in the 1790s, before he came to England; during his time there he is known to have erected a mill for sawing and polishing marble.³

But his new, patent large-diameter circular saws were the most effective yet and set the standard for years to come. Although the first trials were disappointing, Brunel told the navy that if introduced at Portsmouth, such saws could reduce the price of sawing from three shillings per 100ft to about sixpence. A mill with four Brunel circular saws and eight men could replace 24 pairs of sawyers (i.e. 48 men) and would take up no more room than an equivalent number of the existing sawing sheds.⁴ The new composite saw displayed not only Brunel's genius for design, but also Henry Maudslay's manufacturing skills, for the engineer had devised better methods of cutting, hardening and tempering, which contributed to its superior quality. Maudslay had recently added a small foundry at his works in St Marylebone, which allowed him to cast his own metalwork, and he had built a new stamping-press for cutting better and more regular saw-teeth. Once the teeth were cut Maudslay had the metal plates heated in a red-hot oven or furnace, then immersed in oil, which hardened them, and then flattened by hammer before being boiled in oil, then hammered again, and finally ground by grit-stones. Brunel also set great store by his patent method of attaching logs to the carriages, and using a windlass to regulate the speed and motion of the carriages against the saws – without which, he said, 'in common sawmills much time is lost'.⁵

The Portsmouth saw trials of 1806 seem to have been as much for Brunel's own personal interests as for navy applications, and greatly inconvenienced and annoyed Simon Goodrich, the engineer in charge of Brunel's activities there whilst Bentham was engaged on a fact-finding mission to Russia.⁶ Brunel had by then acquired business partners, and with them apparently had taken land at Limehouse. Here he intended to build his private block factory and sawmills, which was to be large enough also to supply all the blocks required by the Royal Navy should an accident befall the Portsmouth mills. Brunel explained the scheme and showed his sketches for the factory to Goodrich at Portsmouth, who noted that there 'appeared the usual veracity of a Frenchman in his statement'.⁷

Brunel continued to prepare plans and test his new machinery in the mills at Portsmouth, where, Goodrich complained, it was 'very much in the way'. Goodrich was apprehensive that the engineer was now 'exceeding all authority' there, pursuing his private interests without any consultation, but was unsure of how to stop him: 'How to cheque it without quarrelling is a difficult matter', he wrote.⁸

By October the intended location for Brunel's private factory had shifted from Limehouse to Battersea, to a riverside works a little to the west of Battersea Bridge, then occupied by a firm called Watson & Company.⁹ Battersea had by then become an important industrial district of London, with a particular emphasis on unpleasant or noxious manufactures such as lime, whiting and cement making; sugar refining, brewing and distilling; and above all chemical manufacture, with a particular concentration in the Nine Elms district of the parish, and other important works further to the west, in the vicinity of the parish church. The availability of cheap land and Battersea's peculiar location were largely responsible for this: it was near enough to the West End and City for the speedy transfer of goods and materials by river, yet far enough removed for its smoking chimneys not to be an inconvenience.

By the early 1800s more manufactories and streets of workers' housing had begun to spread east from the parish church and village centre towards Battersea Bridge. The bridge had been built in 1771, largely

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at the behest of John, 1st Earl Spencer, the lord of the manor and major landowner, as the parish's only river crossing and connection with the north bank. Within another 50 years this entire stretch of riverfront had become solidly built up with wharves and factories (see Figs 2, 7). Brunel liked the Battersea site greatly, principally for its proximity to Chelsea and good transport links: '476 feet along the River and contiguous to two Turnpike Roads will always be of great value', he wrote to his partners, 'where can you meet with such [a] spot?'¹⁰ He may also have been influenced by the connection with George John, 2nd Earl Spencer (who had succeeded his father in 1783), and his wife the Countess Lavinia, whom Brunel considered his friends. It was the 2nd Earl who, during his tenure as first lord of the Admiralty, had been instrumental in securing Brunel's contract at Portsmouth.¹¹



Fig. 2. Excerpt from the first Ordnance Survey edition of the 1860s (1:50,000), showing the sawmill, to the west of Battersea Bridge, and the dock and pier of the City Steam Boat Company, to whom it then belonged

According to Brunel, England's big private shipowners were prepared to offer him 'every encouragement' to build his private factory. East India Company directors had been among the many visitors to the Portsmouth blockmills and had been favourably impressed. Brunel wrote to Henry

Maudslay early in November 1806, offering him two-thirds of the rights to his block-making patent if Maudslay were prepared to pay a £3,000 premium to join a small consortium and advance another £16,000 to pay for the factory building and machinery.¹²

Maudslay's response is not known, but within days Brunel had decided to set aside the private blockmills scheme in order to concentrate his and Maudslay's energies on establishing a steam-driven sawmill specializing in the cutting of veneers and thin boards. Acutely short of income, Brunel felt that, of all the private projects he then had under consideration, this seemed to promise 'in case of success, a very handsome and speedy return'.¹³ He had that year secured a patent for a new method of veneer-cutting,¹⁴ and further patents relating to circular saws and sawmill machinery came in 1808, 1812 and 1813. This period of his career was largely devoted to perfecting new powered machinery for working timber, and he was undoubtedly at the forefront of sawmill and woodworking technology. He was specifically sought out in 1808 by the Ordnance Department to design a steam-driven sawmill for the Royal Arsenal at Woolwich, which occupied him for several years, during which time he was also asked by the navy to provide detailed estimates for designing and building powered sawmills for all the Royal Dockyards – though in the end only that at Chatham seems to have gone ahead. He also supplied new stave-cutting machines for the victualling yard at Deptford. Each of these yards was under intense pressure to modernize and improve efficiency at a time of war.¹⁵

The first Battersea veneer-cutting sawmill of 1806–7

Brunel's partners at Battersea, and presumably from the outset of the private blockmills project, were James Handford Farthing and his kinsman William Farthing, both of whom had businesses in the City as pocket-book makers, at Cornhill and Cheapside respectively. James was also described variously as a cutler, writing-desk maker, and manufacturer of writing-machines and polygraphs; William was also a jeweller.¹⁶ Brunel is said to have sunk all his spare capital into the Battersea speculation, but J. H. Farthing also provided finance. Biographers of Brunel claim that whilst Brunel concentrated on the practical side of the venture, it was Farthing who provided the business acumen; and they attribute its early success as much to the latter's prudent management as to the former's mechanical ingenuity.¹⁷ It was the Farthings who were the principal ratepayers for the property between 1806 and 1812, not Brunel; and it was J. H. Farthing whom Brunel asked to procure him lodgings near by, alighting eventually upon a house in Lindsey Row (later No. 98 Cheyne Walk), Chelsea, part of the former Lindsey House, where he had moved his family by August 1807.¹⁸

Of all the sawmills designed by Brunel, that at Battersea was probably the most sophisticated architecturally, being in a severely simplified, astylar mode of neo-classicism (Fig. 3). No other Brunel sawmill looked quite like this, his other plans generally making use of columns or pediments.¹⁹ Although no drawings by Brunel for the Battersea building were thought to survive, one sheet of designs, bound with others of 1812 for the naval sawmill at Chatham, appears to relate to it, as it bears no resemblance to the other Chatham drawings, or to what Brunel eventually built there, but records an almost identical structure to that at Battersea (Fig. 4).²⁰

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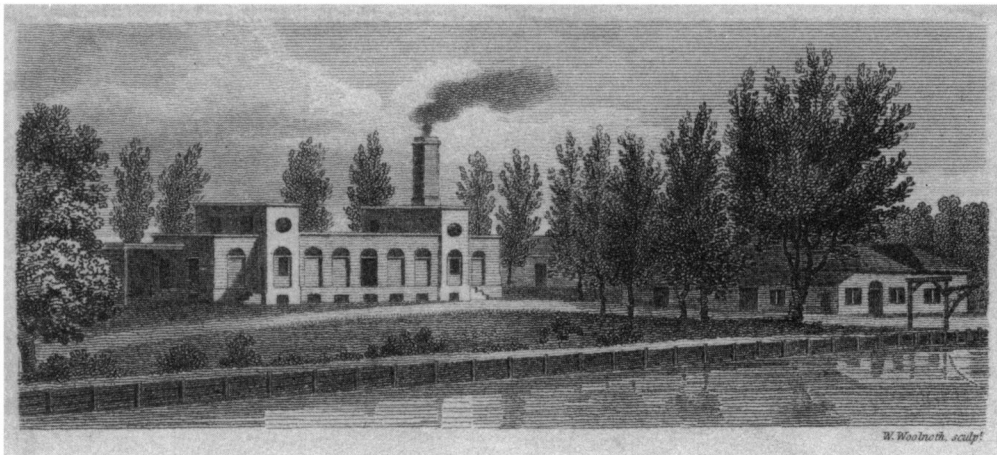


Fig. 3. Early nineteenth-century engraving (c.1812), showing Brunel's Battersea sawmill of 1806–7 before its partial destruction by fire in 1814. The building to the right, partly obscured by trees, is probably the army boot & shoe factory added in 1810 (LMA, SC/PZ/BT/01/038)

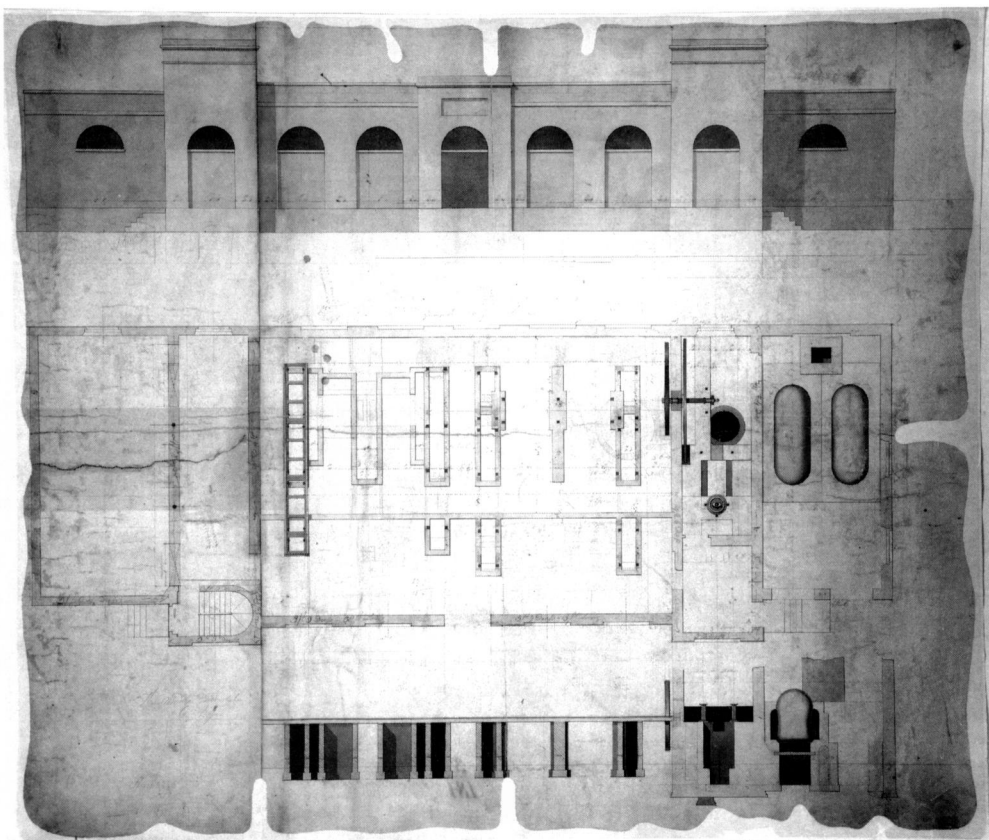


Fig. 4. Undated elevation, plan and partial section of a sawmill by M. I. Brunel, thought to relate to his work at Chatham Dockyard, but almost certainly of the building built in 1806–7 at Battersea (TNA, ADM 140/98 (4))

The plan shows, amongst other things, the long wooden and iron sawing benches in the centre of the building. The steam-engine house – in this instance apparently designed to take a 16 horsepower engine specially made for Brunel by Fenton, Murray & Company of Leeds²¹ – is situated in the ‘pavilion’ to the right, where two wrought-iron waggon-boilers, a water cistern, chimney, and the flywheel which drove the belts or bands that powered the saws are all clearly visible. This type of layout was entirely characteristic of Brunel, and was to be replicated in the plans he devised in 1808–12 for the Chatham and Woolwich mills.²² Beneath the plan, a sectional drawing indicates the deep foundations needed for the engine, and also for the long saw-benches or frames. At Chatham the frames were secured to masonry footings, and at Woolwich the steam-engine was fixed to a large cast-iron foundation plate, and it seems likely that arrangements at Battersea would have been similar.²³ Some idea of Brunel’s outlay on the Battersea mill can be gleaned from detailed correspondence relating to that at Woolwich, which was roughly equivalent in size. There the building cost around £4,000, and the engine and machinery another £4,600 (excluding Brunel’s personal fee of just over £5,000).²⁴ All the sawmills built by Brunel in the early nineteenth century were of brick, with iron-framed roofs, though that at Battersea seems to have been unusual in having its main front entirely rendered.

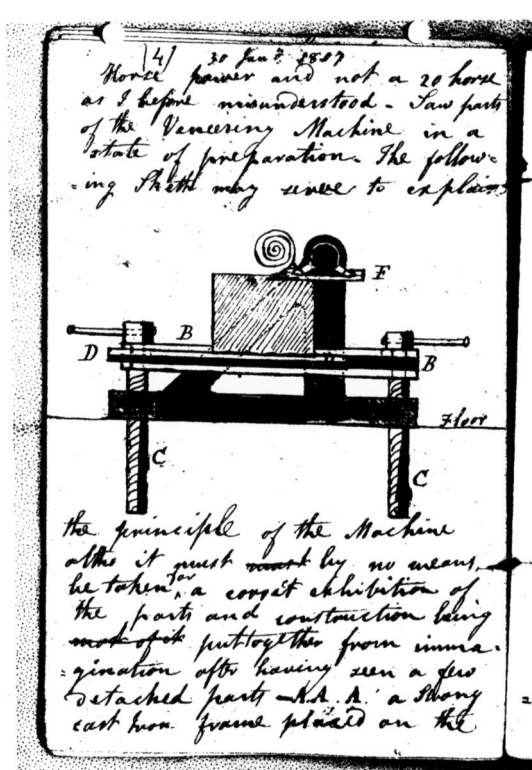


Fig. 5. Simon Goodrich's sketch of Brunel's patent veneer-slicing machine, designed specifically for the Battersea sawmill (Science Museum Library & Archive Swindon, Goodrich Papers and Memorandums, Book 17, 30 Jan 1807, p. 3)

However, it was not the building but the beauty and efficiency of the machinery, made by Maudslay to Brunel's specifications, that struck most early visitors. In January 1807, before the sawmill was in operation, Simon Goodrich saw some of the new patent veneer-slicing machines being prepared for

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assembly in Maudslay's Marylebone workshops, and sketched an approximation of how these would work (Fig. 5). Large sections of wood were held in place on sliding cast-iron frames or tables, which could be raised or lowered to make different thicknesses of veneer, and then moved against a cutting blade, which Goodrich said sliced the thin veneer 'like a roll of paper'.²⁵ This machinery would most likely have occupied the pavilion at the far end of the building, shown as empty on the plan. Again, such an arrangement is entirely typical; in most of Brunel's sawmill schemes the second pavilion is labelled as a workshop, that at Chatham, for instance, being specifically described as 'for machinery to work in Wood'.²⁶ As well as the slicing machines, there were also four great circular saws, which were probably situated in the main central part of the mill, two of 18ft diameter, two of 9ft, with especially fine blades and teeth larger than usual to prevent the saw clogging with sawdust and tearing the fine veneers. An early visitor, Sir Richard Phillips, watched these saws shave planks of mahogany and rosewood into veneers one-sixteenth of an inch thick, 'with a precision and grandeur of action which was really sublime'. With machines like these Brunel could provide raw materials for furniture-makers and hat-box makers at a fraction of the previous cost.²⁷

In addition to veneers, grooves and 'rabbets' were also cut from timber for the first time by machine, and for profit. Traditionally, these were cut by hand in little chips, which were discarded as worthless; but Brunel's saws could remove the wood in long strips, which could then be made use of commercially as rails, laths or mouldings.²⁸

Brunel spent about a fortnight at the end of June 1807 overseeing the erection of some of Maudslay's machinery at the Battersea sawmill, but the building was not complete and ready for operation until that September.²⁹ For the first few years of operation under the Farthings, the business was a success, with at one point orders for almost £5,000 over a five-month period. Also, such was the growing renown of both Brunel and Maudslay after their work at Portsmouth that the machinery itself attracted customers. In 1810 James Borthwick, owner of a sawmill at Leith near Edinburgh, ordered similar saws and equipment from Brunel, as well as designs for new buildings, all of which were completed in 1810–11, Brunel himself travelling north to inspect the site, then sending a millwright named Brown to install the circular saws and machinery. And the Duke of Atholl also invited Brunel and Farthing to erect a similar operation on his estate near Dunkeld, though in this case it is not clear if the scheme was ever carried out.³⁰ And so perhaps the Battersea sawmill should have continued to prosper, thus fulfilling Brunel's desire to provide for his family; but soon several factors combined that shattered his already brittle finances and were to lead to his arrest and imprisonment.

Perhaps the biggest blow was the Farthings withdrawal from the business around 1812. They were replaced as partners by Brunel's brother-in-law Thomas Mudge junior, son of the prominent clock and chronometer maker of the same name, but apparently a less able businessman.³¹ Also, by then Brunel – a prolific, restless inventor – had embarked upon another private industrial speculation at Battersea, one that was to contribute considerably to his eventual ruin.

The army boot and shoe factory

This was a factory making boots and shoes for the army, established in 1810 in a new building alongside the private sawmill – this is probably the simple, low building visible behind the trees to the right of the sawmill in an early nineteenth-century engraving, with low-pitched hipped roofs (Fig. 3).³² Once again the philosophy of mechanization and mass-production introduced by Brunel at Portsmouth prevailed: everything was cut or made on a production line of ingenious Brunel machines, operated not by skilled cobblers but by some 25 unskilled disabled army veterans, who could be trained in a matter of hours. The end result, as at Portsmouth, was greater precision, uniformity and economy.

Most Brunel commentators repeat the story that this venture was inspired early in 1809 by the sorry sight of British soldiers returning to Portsmouth from the Corunna campaign, where the shockingly poor state of their footwear had caused terrible injuries during the winter retreat across the Galician mountains. But Brunel's own explanation of the boot factory's origins fails to mention this. In a letter to Earl Spencer, he explained that it began when he was approached in 1810 by an unnamed 'respectable' army clothier to invent an apparatus for making military shoes, presumably with a view to entering into partnership. When the clothier withdrew shortly afterwards, Brunel decided to pursue the project alone. In this he was encouraged by Mudge, whom Brunel credited with the idea of employing only invalid ex-servicemen.³³

As at Portsmouth, Brunel devised a complete system, described in his own journals as comprising 16 machines, each performing a different stage in the manufacturing process.³⁴ Soles were cut on an iron frame, the inner one then being laid over the leather uppers, which had been stretched and clamped to a cast-iron last. The outer sole was then clamped in place and pierced with holes by an awl at the end of a treadle-activated iron plunger. The same plunger was then used to hammer in the metallic pins or nails that held the shoes together. Sir Richard Phillips saw the factory in operation, and thought Brunel had modernized shoemaking to a degree comparable 'with the oft-admired manufacturing of pins'.³⁵ An extra machine was added later to make the nails used in shoe production, and Brunel also invented and patented a special process to make the leather used in shoe-making more durable. The Brunel machines could produce nine different sizes of boot and shoe, ranging in style and price from common shoes at 9s 6d a pair, to Wellington boots at 20s. These were all 'straights' – that is identical for each foot, rather than designed as rights and lefts – a technique that had the advantage of requiring fewer lasts. Soldiers would swap the boots regularly from foot to foot to extend their life.³⁶

It is not clear that Brunel had any kind of official contract for supplying the army's footwear. Following a few tentative early purchases by the government, he claimed later to have been 'prevailed upon and induced' by 'flattering encomiums' and verbal promises from very high-ranking visitors to the factory – including Lord Castlereagh and the Duke of York, the Commander-in-Chief of the British forces – to invest in expanding the business to supply all the British soldiers with new boots and shoes, increasing production from about 100 pairs a day in 1810 to 400 by 1812. In so doing he claimed to have 'drained and diverted' all the private funds he had set aside to provide for his family.³⁷ After Napoleon's abdication in 1814 he also made some military shoes for the French war ministry, and by February 1815 was in Paris negotiating to supply them with machinery and workmen for a similar operation in France, but Napoleon's unexpected return to power the following month severed that relationship.³⁸

Brunel was proud of the quality of his products, which he said could be re-soled easily by their owners if required, and by March 1815 was happy to announce that his was the only such establishment still in operation – suggesting that competitors in the factory production of army footwear had existed but failed. He also said that soldiers at Chelsea Hospital who had returned from campaigning in Spain were still wearing his shoes.³⁹ Wellington's soldiers at Waterloo are said to have worn boots made by Brunel at Battersea.⁴⁰

But when peace came in November 1815 the British government had no need for Brunel's wares on such a vast scale, leaving him with a stock of some 80,000 unwanted pairs of boots. He complained to Earl Spencer that 'no consideration' had been given to his service, which was 'of national importance', claiming to have spent some £15,000 on buildings, machinery and materials. Brunel eventually asked Nicholas Vansittart, Chancellor of the Exchequer, for compensation, saying that he would never have invested so much 'unless buoyed up with the assurance and hope that Government would support me', but none was forthcoming. Desperate for cash, Brunel tried unsuccessfully to sell his machinery to the Treasury, and having failed in his negotiations with the French government, wrote to the Prussian

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government in 1819 with plans for a national army boot factory along similar lines, but apparently to no avail.⁴¹

The destruction and rebuilding of the sawmill, 1814–16, and financial disarray

Brunel's desperation had been compounded by further misfortune in August 1814 when the Battersea sawmill was almost entirely consumed by fire. With exceptionally bad timing, the fire coincided with one of London's worst warehouse fires, at Bankside. Such was the scale of the latter inferno that only three fire-engines could be spared for Battersea; and, with the tide at a low ebb, very little water could be brought into play.⁴² Much of the stock of timber and veneer was rescued, but the result was the destruction of all but the right wing of the sawmill and its steam engine. The *Gentleman's Magazine* lamented the reduction of Brunel's machinery, 'which, in point of execution and perfection, exceeded every thing we know', into 'the awful sight of a heap of fragments'.⁴³

Brunel reacted positively, viewing the disaster as an opportunity to make improvements. He told Joshua Field, with whom he was working on the naval sawmill at Chatham when the news of the fire was brought to him: 'I can make better machinery now'.⁴⁴

The sawmills were indeed rebuilt in a slightly different form and were fully operational again by 1816.⁴⁵ In plan the building was similar to its predecessor, repeating Brunel's regular arrangement of central mill-house with flanking pavilions, but these now had pediments; this was basically the form the sawmill retained until its demolition in the late 1970s (Figs 6, 7, 8).

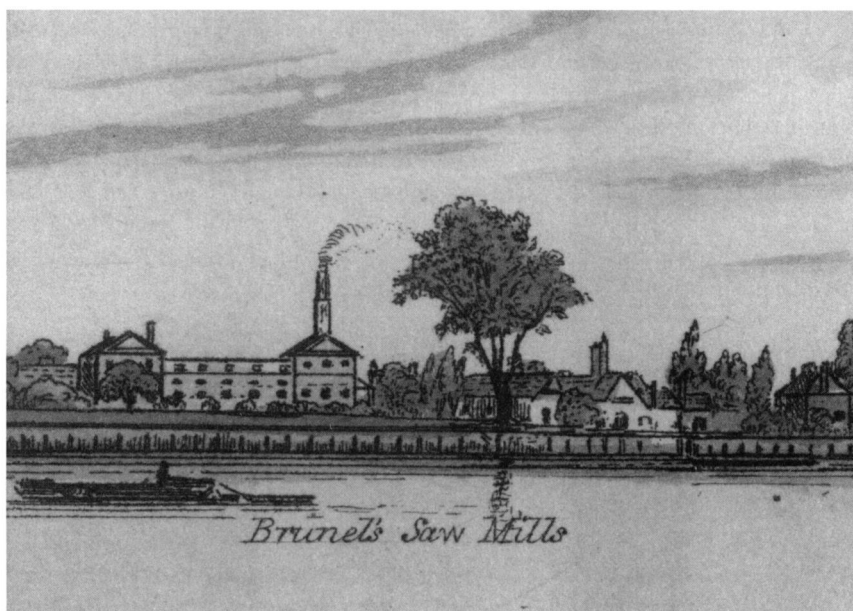


Fig. 6. Brunel's Battersea sawmill as rebuilt after the fire of 1814. From Samuel Leigh's *The Panorama of the Thames from London to Richmond* of 1829 (LMA, SC/GL/LEI/001, 002)

By this date Brunel's finances were in disarray. There had been £10,000 in his bank account in October 1813, but at the time of the Battersea fire in 1814 his balance stood at just £865. Eventually he asked a Mr Sansom, a City banker and friend, to investigate his business affairs.⁴⁶ This was probably

Philip Sansom of Leytonstone House (d.1815), whose bank of Sansom, Postlethwaite & Sansom was based in Lombard Street. He had been a member of Wilberforce's London Committee for the Abolition of the Slave Trade.⁴⁷ Sansom soon found that Brunel had allowed the Battersea shoe-factory finances to become enmeshed with those for the adjoining sawmills: 'It was a most extraordinary jumble', he wrote to Brunel in January 1817, 'which you certainly have not understood, and I should have wondered if you had. I should hardly have been more surprised than I am if one of your saws had walked to town'. In a failed attempt to unravel this complex financial muddle, Brunel's partners seem to have spent heavily on legal counsel. 'If you have ever been ill in your life, and have depended upon medical advice', wrote Sansom, 'fall down on your knees and bless God that you had fewer doctors than you have had lawyers about you'.⁴⁸

Tinfoil production at Battersea and imprisonment

But rather than focus on either the sawmill or boot-factory at Battersea, in 1816–19 Brunel became engrossed in new private ventures, including a circular-frame knitting-machine (or 'Tricoteur'); an experimental rotary-press for printing newspapers; and the manufacture of a new type of crystallized decorative tinfoil. The last of these also took place at Battersea, most likely in part of the army boot factory, which would have ceased operation.⁴⁹

By then Brunel, acting on Sansom's advice and with his assistance, had reeled in some new business partners, either in place of or in addition to Mudge. These were Samuel Shaw, another personal friend, and William Hollingsworth of Nine Elms, a local landowner with a lime-burning business at Nine Elms and a brewery in Southwark; Hollingsworth was joined in the partnership at Battersea by a brother, probably Samuel.⁵⁰ The details are unclear, but Shaw was certainly engaged with Brunel in the decorative tinfoil scheme, the Hollingsworths apparently only in the sawmills.

Brunel patented his tinfoil process in 1818.⁵¹ Standard tinfoil, as used in the looking-glass trade, was rolled and heated during production, and did not lend itself easily to crystallization. But Brunel found that by smoothing a very thin layer of foil on a heated table or plate at close to its melting temperature, and then applying additional heat to its surface with a gas flame, he was able to produce a delicately crystallized patterned surface. This could then be varnished or coloured and used to decorate all manner of objects – from small items such as snuff or patch boxes, to lamp columns, urns and cabinets, even coaches. It was stocked and sold by Ackerman's on The Strand. In December 1818 Brunel presented the Prince Regent with a screen made of the patented tinfoil, and some of the rooms at Brighton Pavilion were apparently decorated in the material, which seems to have lent itself to Eastern designs, as it was also exported to Madras and Calcutta.⁵²

Despite his patent, Brunel's new tinfoil process was widely pirated, and failed to bring the economic success he had hoped.⁵³ Also, Shaw, whom Brunel seems to have entrusted with the commercial side of the business, proved to be a reluctant, sluggish ally. As early as May 1818 he was considering abandoning the scheme, writing to Brunel that he was 'so sick and tired of the vexatious occurrences and disappointments at Battersea, that I should be glad to get rid of the whole concern altogether... As to going out to the works, I must give it up. The walk is too much for me, and, upon my honour, I cannot afford 12s. for the ride'. He also complained of insufficient space at the factory to meet demand, as by then more than half the premises had been let to tenants, presumably by Brunel or one of his other partners, in order to generate extra income. Having filed another patent in December 1818, for a second type of metallic paper, which like the original was well-received in Paris as well as at home, Brunel realized that want of proper promotion and organization had allowed another potentially lucrative business to slip through his grasp – 'as Ackerman says', he wrote to Shaw, 'much may be done; but not

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in the way we do it'. Eventually, Brunel lost his patience. 'Now, my dear sir', he wrote to Shaw in 1819, 'it is six months, if not more, since you have put your foot on the premises of a concern in which you are so deeply interested... You have had accounts; the books are in good order; the manufacturing part is, I think, complete; but the main point is left to chance. I would rather sacrifice the whole at once than suffer things to go on in the present way'.⁵⁴

Brunel did not have long to wait for things to come to a head. Within two years his financial position had deteriorated further, and apparently the failure of his bank (Sykes & Co.) finally left him unable to ward off his creditors. As a result he was arrested for debt in May 1821 and taken to the King's Bench prison; his loyal wife Sophie chose to be confined with him. After three months of incarceration, the efforts of several influential friends and patrons – including Lord Spencer and the Duke of Wellington – persuaded the government to advance Brunel a grant of £5,000 in recognition of his services to the nation, in order to discharge his debts and thus secure his release.⁵⁵

After he emerged from prison, Brunel eventually rid himself of what remained of the boot-making and tinfoil businesses, latterly retaining only a half-share in the sawmill. The Hollingsworths, who are generally depicted as the villains of the piece and are said to have swindled Brunel out of money, were last listed as ratepayers there in 1822. Their successors Mudge & Co. had gone by 1827, and with them went any lingering association of the site with Brunel.⁵⁶

Later history of the Battersea site

The sawmills and Brunel machinery were subsequently acquired in about 1828 by John & James Watson & Co., sawyers and veneer-cutters, who remained in business there until c.1849. After their departure their family retained the freehold until about 1900.⁵⁷

By 1849 the site had been taken over as part of the steamboat yard of the Citizen (or City) Steamboat Co., which had been established in 1845 to secure a slice of the then burgeoning and lucrative trade in Thames paddle-steamer services (Figs 2, 7). Its boats plied between London Bridge and Chelsea every 10 to 15 minutes. Increasing competition from improved road and rail services badly affected business, and in 1875–6 the Citizen merged with the other small riverboat companies to form the London Steamboat Company Ltd. But the tragic sinking of one of its vessels, *Princess Alice*, in 1878, badly undermined the trade and the company was eventually wound up in 1884.⁵⁸ A successor company lasted only two years, and so in 1888 a new concern, the Victoria Steamboat Association, purchased the fleet and took over its wharves, including that at Battersea, but this, too, was shortlived.⁵⁹

In 1897 the Victoria Steamboat's fleet and piers were acquired, through an agreement with the receiver, by a new company, the Thames Steamboat Company, owned by Arnold Hills, chairman of the Thames Iron Works & Ship Building Company, then the largest shipbuilding concern on the Thames. Hills attempted to revive riverboat services, latterly to the annoyance of the London County Council, which from the early 1900s was trying to buy up the remaining steamboat piers and introduce its own municipal fleet. Eventually Hills's company failed and its Battersea yard was acquired around 1905 by the adjoining Morgan Crucible Company – one of the giants of Battersea's riverside industry at the turn of the century – as part of its continuing expansion.⁶⁰

Aside from adding a new roof, Morgans seem to have made few alterations to Brunel's sawmill, which they used as a store and workshop, and it survived largely unrecognized among much larger and later buildings (Fig. 8) until the works were closed and entirely demolished in the late 1970s to make way for a housing development.



Fig. 7. Detail from an undated nineteenth-century photograph of Old Battersea Bridge (replaced 1886–90), looking west, showing the former sawmills, then in use by one of the London steamboat companies; a pair of long-funnelled paddle-steamers sit in the river beside the passenger pier. Beyond are the chimneys of the chemical industries of Church Road, the spire of St Mary's Church, and, in the far distance, the West London Extension Railway Bridge of 1863 (NMRC, BB82/13057, Philip Norman Collection)



Fig. 8. Detail from an aerial view of 1937 of the Morgan Crucible Company Ltd's riverside factory near Battersea Bridge; the Brunel sawmill stands in front of the central building bearing the company's name (NMRC, AFL03/AEROPICTORIAL/R1868)

*Fine veneers, army boots and tinfoil:
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