

Industrial Glimmerings



Massachusetts before 1790

I say that America will not make manufactures enough for her own consumption these thousand years.

—John Adams to Benjamin Franklin, 1780

The time is not distant when this Country will abound with mechanics & manufacturers who will receive their bread from their employers.

—Gouverneur Morris, 1787

Samuel Slater established the first successful water-powered cotton spinning mill in America. Slater was an English textile factory superintendent who had gained a thorough knowledge of Arkwright machinery, emigrated to America in 1789, and teamed up with Moses Brown to establish his factory on the Blackstone River at Pawtucket, Rhode Island, in 1790. His notable achievement has obscured important indications of a vibrant—if still experimental and often unprofitable—textile industry elsewhere in America at the close of the eighteenth century. Another notable industrial endeavor before 1800 was Alexander Hamilton's manufacturing enterprise at Paterson, New Jersey, begun in 1791, and most famous for its dramatic collapse, due to poor management, inadequate facilities for workers, dumping of shares by the speculation-minded investors, and the financial improprieties of its director.¹ And it may be this well-known domestic failure and the Englishman Slater's success that have led to the general impression that before 1790 America was not ready for large-scale manufacturing, and that whatever meager success was achieved must be attributable

to British contributions. Industrial innovation in other villages and towns in America, however, makes it clear that powered textile manufacture had been developing for some time, and had reached the size and scale at which the term *factory* is appropriate. Furthermore, although British machinery designs as well as skilled British immigrant workers were often involved, the bulk of the factory and machine building—the work force that kept the mills and machinery running—was distinctly American.



The colony and state of Massachusetts had long been a promoter of local textile manufacture. This encouragement ranged from financial aid to coercion, as in 1656 when the general court ordered all families to engage in home spinning to redress the scarcity of cloth. An early spinning school was established in Boston about 1718 to provide work for the poor, but likely for profit as well. As early as 1726, to help satisfy the need for duck (a heavy cloth for sails and work clothes), the General Court awarded a bounty to a Boston linen manufacturer. In the early 1750s, the Society for Encouraging Industry and the Employment of the Poor was formed, with philanthropic motives mixed with the desire to secure bargain labor. When the society petitioned the General Court to erect a building for linen manufacture, it was approved provided that the owners furnished training in spinning and weaving.

The building was used intermittently for various types of textile production, including a spinning school organized by William Molineux. In a petition to the colonial legislature in 1770, Molineux claimed that he had “learned” more than three hundred women and children to spin. Soon he had warping and twisting machines and at least ten looms in operation. This was probably the closest thing to a textile factory in America before the Revolution. Little is known about the equipment or the actual operation of the enterprise. What is important is that it was a sort of factory, it had government aid, and its ostensible aim was to give work to the poor. This description will be echoed in late-eighteenth-century attempts at industrialization in Massachusetts, although profit will become a more obvious goal.²

The other colony and state that notably promoted textile manufactures was Pennsylvania. In March 1775, the *Pennsylvania Gazette* reported on a meeting of subscribers to “a fund for establishing an American Manufactory of woolsens, linens, and cottons.” The organization behind this plan was the United Company of Philadelphia for Promoting American Manufactures. One of its members was Tench Coxe, a tireless promoter of manufacturing and later Alexander Hamilton’s assistant secretary of the treasury. Another was Dr. Benjamin Rush whose speech at the inauguration of the society stressed the combination of economic, scientific, and philanthropic advantages to manufacturing.³

The manufacturing established by the United Company did not utilize the latest machinery. In Philadelphia, a manufactory was typically intended for poor relief on the British model, and between 1775 and 1790 the United Company employed more than four hundred women who spun yarn in their homes. In this variation on the classic “putting out” system, the yarn was purchased by the manufactory owners to be woven into cloth within the factory. By 1789, spinning jennies were in use in the company’s Market Street factory, but a year later—reminiscent of the mob action of threatened hand workers in Britain—it was destroyed by arson.⁴

Philadelphia’s textile industry would expand significantly, but not until after the War of 1812. To take one prominent example, Rockdale—so carefully documented by Anthony F. C. Wallace—began development in 1825. For a number of reasons the Philadelphia-area experience was different from that of New England. Since a major aim of manufactories in Philadelphia was to provide work for the poor, they concentrated on labor-intensive operations rather than labor-saving machinery. As a major immigration port (unlike Boston), a steady supply of English and Irish hand spinners and weavers was available, making the traditional putting-out system economically feasible (for the entrepreneurs, if not for the workers). Finally, because of the abundance of skilled mule spinners and handloom weavers, Philadelphia became a center for the production of fine goods, which early spinning and weaving machines did poorly. In short, the availability of water-powered textile machinery did not revolutionize work in Philadelphia as soon or as rapidly as it did in New England.⁵

This by no means suggests that the Pennsylvania-Delaware area was somehow incapable of supporting mechanical innovation. Oliver Evans, a brilliant and multifaceted inventor well known for his experiments with high-pressure steam engines and his creation of the first automated flour mill in 1787, got his start in manufacturing during the Revolution. Cards for combing wool (wooden paddles covered with leather embedded with small bent wires) were typically made by hand, but in 1777, Evans designed a hand-cranked machine that would precisely cut and bend the wire teeth, and another to insert the wires into the card. After his appeal to the Delaware legislature for \$500 was turned down, Evans found a Wilmington textile manufacturer who contracted to implement his design. The machine made five hundred wire teeth per minute, and a later improvement brought the number to three thousand.⁶ The fact that there existed a machine manufacturer in 1770s America capable of fabricating Evans’s invention says much about the state of industrial development during this period. While America remained in the thrall of British mercantilism and was still industrially primitive, there were many signs of capacity and ingenuity as well as actual practical work already going on.

From time to time the federal government actively encouraged cotton and woolen manufactures, as attested by President Washington’s high-profile

tours of textile factories in 1789. Another strategy was to send recruiters to England and Ireland in search of knowledgeable machinists or models of the latest textile equipment. One such recruiter was Thomas Atwood Digges of Maryland, who spent the Revolutionary War years in England, and was accused by Benjamin Franklin and others of espionage. George Washington came to his defense, pointing out that Digges's more recent work had been invaluable: "Since the War, abundant evidence might be adduced of his activity and zeal (with considerable risque) in sending artizans and machines of public utility to this Country."⁷

Although older style carding machines and spinning jennies were occasionally imported, the holy grail of industrial espionage in this period was the Arkwright spinning frame and associated machinery, and as early as 1787 the U.S. Congress began secret attempts to procure it. Some of the impetus for American action may stem from the fact that by 1785, Richard Arkwright was so upset at Parliament's invalidation of his patent rights (by refusing to support his claim of patent infringements) that he threatened to "publish descriptions and copper plates of all the parts, that it might be known to foreign nations as well as our own." Now the American position became more public, when William Pollard, a merchant in Philadelphia, secured a model of an Arkwright roving and spinning machine in 1788 or 1789, made improvements (since it did not function), and applied for a U.S. patent in 1790. Although this put the United States government in the position of officially condoning the patenting of stolen intellectual property, Pollard was awarded the patent in December 1791.⁸

Prior to 1790, however, the federal government did not play a significant role in industrial development, although it is likely that Washington's visits helped change public sentiment. The most influential national figure was Tench Coxe, the moving force behind the Pennsylvania Society for the Encouragement of Manufactures and Useful Arts and later assistant secretary of the treasury, where he produced the primary draft of the famous Report on Manufactures (1791) and played a major role in the creation of the Society for Establishing Useful Manufactures.⁹ Coxe also acted for personal gain, as when he used his own funds to send an agent, one Andrew Mitchell from western Pennsylvania, to England to acquire models or plans of Arkwright machinery. Mitchell managed to buy the models and drawings, but was caught by British authorities, fined, and forced to leave the country empty-handed. Coxe may have been more successful indirectly, as some of his promotional material appears to have been an important factor in Samuel Slater's decision to emigrate to America in 1789.

Unlike many Americans in the late eighteenth century, Tench Coxe had no problem reconciling the need for manufacturing with agriculture. He recognized early on that America needed industry to lessen its dependence on Europe, and that in a labor-starved nation, machinery would be an essential component of the economy. But Coxe had many detractors (John Adams described him as a "wily, winding, subtle and insidious character") and the American effort was

desultory at best prior to Hamilton's Report on Manufactures in 1791.¹⁰ Private initiative, enterprising British mechanics willing to emigrate, and state bonuses and tax relief would be far more important factors than federal aid or encouragement, and nowhere was this more true than in the state of Massachusetts.



After the Revolution, Massachusetts was a leader in legislative inducements for textile machinery. In October 1786, a joint House and Senate committee was appointed "to view any new invented machines that are making [*sic*] within this Commonwealth for the purpose of manufacturing sheep's and cotton wool, and report what measures are proper for the Legislature to take to encourage the same."¹¹ Earlier that year, two brothers, Robert and Alexander Barr, had emigrated from Scotland to East Bridgewater where, as employees of foundry and firearms manufacturer Hugh Orr, they built carding, spinning, and roving machines, based on British (probably Hargreaves) designs. The Massachusetts legislature, "as a reward for their ingenuity in forming those machines and their public spirit in making them known to the commonwealth," awarded them a £200 cash bounty and six tickets in the state land lottery. This was a coup for Massachusetts, which had managed to evade British export laws and boosted the state's chances of producing a viable textile industry. The machines were put on exhibition as "State's Models" for interested parties to examine.¹² Another British émigré, Thomas Somers, had settled in Baltimore in 1785, where he perceived that there were opportunities in America for those with knowledge of British textile machinery. After returning to England to obtain models of relevant machines, he settled in Massachusetts and petitioned the General Court in February 1787 to help him recover from the loss of half his property at sea and tide him over until he could engage in the textile business. Somers soon produced an Arkwright spinning frame in Orr's workshop in March 1787, and was awarded £20—whether as encouragement before he built the machine or reward afterward is unclear.¹³ This state involvement was a critical spur to industry, much of it directed to enticing European machinists familiar with latest British textile machinery to emigrate. It also signaled to local machinists that, with the right skills and experience, there might be economic rewards.

The first mechanized cotton spinning manufactory in New England was established in Beverly, along the Massachusetts coast north of Boston. John, Andrew, and George Cabot—brothers who had made a fortune in shipping and distilleries, as well as privateering during the Revolution—organized the Beverly Cotton Manufactory in 1787. They constructed a small brick mill on Bass River the following year with several spinning jennies and carding machines built by James Leonard and the same Thomas Somers who had built the state models in Bridgewater. Weaving, performed on hand looms, was done in the same building, suggesting an early form of the integrated factory—one

that comprised all the production stages, from raw cotton to finished cloth—although the machinery was powered by horses rather than water.¹⁴

While profit was the obvious motive, the investors phrased their incorporation petition to emphasize the public good: not only would the factory's output reduce the dependence on foreign imports, but it would employ women and children who might otherwise be a burden to society. Forty people, in fact, were employed in 1790. The petition also spoke of financial sacrifice and risk, with careful positioning to induce the court to grant the owners certain immunities or aid in return for their public-spirited pioneering. The Beverly manufactory had already benefited from state aid by securing the services of machinists Leonard and Somers, at least one of whom had received a bonus from the Massachusetts legislature. According to the Salem *Mercury*, however, it was George Cabot who had essentially saved these artisans from returning in disappointment to Britain:

With such talents [Leonard and Somers] supposed that the risk and expense of coming to this country would be amply recompensed by the encouragement such valuable manufactures deserve. But they made various applications with no other effect than loss of time and money. Such difficulties, co-operating with the want of energy and system in our governments, reduced them to the disagreeable necessity of resolving to leave a country so unpromising to manufactures, when the Hon. George Cabot generously patronized them, and influenced a number of gentlemen in Beverly to associate for the purpose of establishing these much wanted industries. These gentlemen merit the thanks of their fellow citizens.¹⁵

Politics were undoubtedly at work as the *Mercury* hewed the Federalist line in chastising the state for insufficient assistance to manufacturing. How Cabot came in contact with the Bridgewater artisans is unknown. Their “disagreeable” state is questionable, however, since—as will become evident later—there was a great deal of interest in their carding and spinning machines, especially from Rhode Islanders who were setting up their own cotton manufacturing.

The Beverly factory received a great deal of national attention as well, highlighted by George Washington's tour of the facility in 1789. A good description of the works can be found in Washington's diary:

In this Manufactory, they have the New Invented Spinning and Carding Machines. One of the first supplies the work, and four of the latter, one of which spins eighty-four threads at a time by one person. The Cotton is prepared for these Machines by being first (lightly) drawn to a thread on the common wheel. There is also another Machine for

doubling and twisting the threads for particular cloths. This also does many at a time. For winding the Cotton from the spindles and preparing it for the Warp, there is a Reel which expedites the work greatly. A number of looms (15 or 16) were at work with Spring shuttles, which do more than double work. In short, the whole seemed perfect and the Cotton stuffs which they turned out excellent of their kind. Warp & filling are both now of cotton.¹⁶

The whole was not as perfect as it seemed, however. Even before Washington's visit, the company had been forced to petition the Massachusetts legislature for £500 to help defray unexpectedly high startup costs. In fact, the president's visit was likely devised as part of the lobbying effort for government subsidy. George Cabot, the most prominent of the investors, was personally acquainted with Washington and Alexander Hamilton. Again in 1790, the investors asked for relief, assuring the state that "the manufacture, having been once established, will be sufficiently lucrative to support and extend itself, and will afford not only a supply for domestic consumption, but a staple for exportation." There may have been a note of desperation in their appeal, for they used as inducements the fact that the raw cotton they imported was traded for codfish, thus providing that local industry with much needed encouragement.¹⁷

The most serious financial problem was the cost of building and maintaining the machines. The carding machine alone had cost £1,100, and by 1790 an equivalent machine could be purchased for as little as £200. This is an indication of the risk that pioneer entrepreneurs faced, as well as the rapid reduction in price that results from technological advances and increased demand. "Our machinery has been bad and dear," lamented George Cabot in 1791, "it is now perfectly well made and cheap."¹⁸ The Beverly Manufactory was also plagued by the loss of trained workers who were lured to other start-up enterprises for higher wages. Moses Brown of Providence wrote to the owners of a textile manufactory in Worcester: "The beaverly people appeared highly offended at your taking the Woman from them, and say they will not again employ her if she returns." Probably more painful was the defection of the English machinist James Leonard to Brown's company in 1789. Despite Moses Brown's positive description of cooperative relationships among the various New England cotton manufactories during this early period, the Beverly owners were furious over the theft of their trained employees. "You are not ignorant," complained George Cabot to Massachusetts congressman Benjamin Goodhue,

that the Worcester people got their machinery made by a man whom we had taught at great expense, and that their carding engine did not consequently cost an eighth part as much as ours; they also took away the second spinner we had instructed. This woman, after hav-

ing destroyed our materials and enjoyed our support in learning to spin, was bribed to desert us as soon as she could be useful to us. The Rhode Island undertakers [Almy & Brown] have, to a degree, treated us in the same manner; and we have not yet been able to stop this evil which has cost us so much money.¹⁹

In their 1790 petition to the House Committee for the Encouragement of Arts, Agriculture, and Manufactures, the Beverly owners presented themselves as public-spirited men who had assumed great risks for the benefit of the fledgling nation. “The proprietors having already hazarded, some their whole fortunes, and others very large sums,” they pleaded, “are obliged to declare, without aid from this honorable court, no further advancement can be made, and, mortifying as it is, they feel themselves in the necessity of relinquishing a design highly beneficial to the public and undertaken by them from the purest motives.” The legislature agreed.²⁰

Yet the following year, despite an appropriation of £1,000 (\$4,500), George Cabot confided to his friend Alexander Hamilton that the investors were currently \$10,000 in debt and making no headway since the price they could charge for the finished cloth was now lower than the net cost of producing it. Cabot explained that “a want in skill in constructing the machinery and in dexterity in using it, added to our want of a general knowledge of the business we had undertaken, have proved the principal impediments to its success.” While this early attempt at mechanized cotton manufacture managed to stay operational for more than twenty years, it was not profitable. The original owners appear to have been whittled down to John Cabot and Joshua Fisher by 1798, at which point they sold the factory for \$2,630.²¹

The unprofitability of the Beverly Cotton Manufactory is easy to explain in retrospect: insufficient capitalization, the high cost of equipment, few trained mechanics, and competition for workers in a tight labor market. As the investors themselves admitted, having made their fortunes in shipping, they lacked knowledge of the new industry they had undertaken. Even the rudimentary, reliable, well-understood principle of water power was not exploited. Perhaps Beverly, like most seacoast towns, had no river with sufficient falls to power the mill. Or the owners could have been using a British model: many small factories in England in the 1770–1790 period used horse-powered capstans to drive the carding machines and did spinning by hand. It also appears that, despite the experimentation done in Bridgewater, the Beverly mill used hand-operated jennies, not Arkwright water frames as anticipated.²² Yet the Beverly investors were trying something entirely new in America, and had few business rules to guide them. The fact that they had paid £1,100 for a carding machine in 1786, and could have purchased one (presumably better) for only £200 in 1790, is strong evidence that they were just a few years ahead of their time. The next

manufacturing experiments would take advantage of improved machinery and water power—and learn specific lessons from Beverly’s failure.



As 1790 approached, all manufacturing roads appeared to lead to Providence. Yet a few brief examples will help to bolster the role of Massachusetts in the development of decentralized textile production and machine manufacture. A duck cloth factory was established in Haverhill in 1789. George Washington visited there after touring the Beverly factory, and deemed the setup “ingenious.” The president seemed particularly impressed with the looms, which were “differently constructed from those of the common kind, and upon an improved plan.” Just what was different is unknown—the point is they were considered innovative. Also in 1789, the Worcester Cotton Manufactory was established on Mill River. The investors included famed printer and American Antiquarian Society founder Isaiah Thomas, and Levi Lincoln, who would later serve as United States Attorney General. The *Massachusetts Spy* declared that the corduroy produced in the mill was preferable to British imports—but we must bear in mind that the *Spy* was owned by Isaiah Thomas. As noted earlier, the Worcester factory had the advantage of a trained machinist from Beverly, which reduced their machine costs considerably. By 1791, however, seventeen of the eighteen original investors had sold their interests, and in early 1792 an appeal to the state legislature for a £600 loan resulted in a ten-year tax abatement, but no money. The enterprise appears to have survived at least until 1799, but within a short time the factory building was sold, moved, and converted to a store.²³

The typical carding machine of this era was a revolving cylinder with removable covers. The card clothing—the leather strips pierced by bent wire staples that performed the actual carding of cotton or wool—was attached to both the cylinder and the covers. The machinist who produced the Worcester factory’s card clothing was Pliny Earle, from the town of Leicester, five miles west of Worcester along the old Post Road. Earle (1762–1832) began making hand cards in 1785 in the employ of Edmund Snow. The following year Earle went into business for himself, and was hired to build the card clothing for the Worcester Cotton Manufactory. Moses Brown may have heard about Earle through the Worcester factory connection, but a more likely link is the fact that they were both Quakers, as were a significant number of the mechanics working with Brown during this period.²⁴ In November 1789—before Samuel Slater came to Rhode Island—Brown contracted with Earle to make the card clothing for the Almy & Brown carding machines.

In an example of early machine specialization, there were several card clothing makers to whom the Providence manufacturer could turn. As Brown’s

letter to Earle reveals, “We have conferred with our Card Makers in Town about doing the Jobb, who appear desirous to do it, and are willing to take their pay, all excepting the cost of the wire in our way, but, it being our object to have it well done, and thinking we could rely upon thy performance, have preferred thy doing it.” Perhaps to make it clear to Earle that he had further competition, the Brown & Almy letter continues, “We have also had it in contemplation to write to Boston, but, being desirous of having it done soon, and that being likely to protract the time of having it done, we waved [*sic*] that also.”²⁵

Two additional important facts can be gleaned from this letter. One is that Earle had made progress in building machine tools to aid in the fabrication of the card clothing: “Thou hast thy machinery now prepared, which was not when thou did that for the company at Worcester.” The other is that Moses Brown was well acquainted with the owners of the Worcester Cotton Manufactory. In advising Earle to go to Worcester to see if he could observe any needed improvements to the cards there, Brown informed him that “Stowell, who superintends the business there, will chearfully give thee any information respecting the working of theirs, no doubt, upon thy own account and upon ours also, as we are upon friendly terms with him, having divers times been mutually helpful to each other.”²⁶ Given how the Beverly owners felt about Moses Brown, we can only wonder how open the Worcester investors might have been.

According to one nineteenth-century account, the first of Earle’s card-clothing installed at Slater’s Pawtucket factory did not meet expectations. In an early example of the traveling repairman, Earle journeyed to Pawtucket to examine the cards himself and found that the pitch of the teeth was incorrect, causing the cotton to clog the machine. He quickly remedied the situation—whether by hand or by machine is not noted—and the carding process proceeded smoothly from this time on.²⁷

Pliny Earle built a machine business, survived the downturn after the War of 1812, and passed on a company that was still successfully making up-to-date carding machines at the end of the nineteenth century. He and his family provide an instructive example of the upward mobility of a mechanically gifted man of the early republic. Two of his sons were educated at the Leicester Academy and went on to distinguished national careers. Thomas Earle (1796–1849) worked in his father’s business until the economic slump of 1816, then moved to Philadelphia where he became a lawyer, newspaper editor, and advocate of immediate emancipation, and was selected (although not ultimately chosen) to be James G. Birney’s running mate for the Liberty Party in 1840. Pliny Earle Jr. (1809–1892) earned a medical degree from the University of Pennsylvania, became a pioneer in the treatment of the insane, and was cofounder of the American Medical Association.²⁸

A failed textile factory in Worcester and a small machine shop in nearby Leicester—for all practical purposes relegated to the dustbin of industrial history—may be more significant than initially appears. First, they indicate a more

extended geographical dimension of pre-1790 mechanized textile development. Bridgewater, Beverly, and Worcester-Leicester form a triangle that covers most of eastern and central Massachusetts. More significantly, all three locations will figure in the success of Moses Brown and Samuel Slater at Pawtucket. Several letters from Almy & Brown indicate that they were keenly aware of machinery, labor, and general business issues in both the Beverly and Worcester factories; a machinist from Leicester made their card clothing; and their initial Arkwright machines were procured from Bridgewater.

The realization of America's first successful cotton spinning mill at Pawtucket, Rhode Island, is properly ascribed to Samuel Slater, and even the briefest biography highlights the fact that he emigrated from England with a thorough understanding of Arkwright machinery in 1789. While his achievement is remarkable, too great an emphasis on Slater obscures the technical experimentation going on in New England before Slater's arrival, the lessons learned from earlier textile factories in Massachusetts, and the general state of industrial development in southern New England in the late eighteenth century. Moreover, the Slater-centric view devalues the contribution of David Wilkinson and other local artisans who actually built the equipment. Wilkinson was a talented machinist who seized the opportunities offered by the evolution of the textile industry and in turn contributed to its further development. His story forms an indispensable part of the early industrial history of America.