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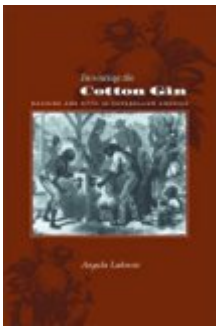
Angela Lakwete. *Inventing the Cotton Gin: Machine and Myth in Antebellum America.* Baltimore and London: Johns Hopkins University Press, 2003. xiii + 232 pp. $25.00, paper, ISBN 978-0-8018-8272-2.



Reviewed by Barbara Hahn

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Eli Whitney did NOT invent the cotton gin. Not exactly.

Historians of technology know that much almost without being told; the discipline has long recognized invention as more complex an occurrence than the action of a single individual. Practitioners in the field encounter every day stories of geniuses and their discoveries. The methods they employ regularly complicate those legends with richer understandings of how social context, local culture, and the trajectory of knowledge shape human dealings with the physical world. From Thomas Edison and the invention of the light bulb to Henry Ford and the development of the assembly line, and now including Eli Whitney and the cotton gin, the history of technology has long been working to replace myths of invention with nuanced studies of how and why technologies work or fail. These studies examine machines and methods by placing them within their contexts and in the hands of the people who make them, adopt and adapt them, use or discard them. [1]

Lakwete joins the pantheon of technological historians by demolishing a standard, widely accepted myth with the careful and persuasive analysis of a vast array of evidence. In order to account for the persistence of the Whitney myth she extends her scrutiny all the way up to the eve of the American Civil War. Lakwete's background amply qualifies her for this investigation of cotton technology from antiquity through industrialization. She conducted doctoral work in the University of Delaware's magnificent Hagley Program in the History of Industrialization and has eighteen years experience in textile conservation at institutions including the Metropolitan Museum of Art in New York City, the Boston Museum of Fine Arts, and the Peabody Museum at Harvard.

Lakwete begins at the beginning. Since before recorded history, the dominant method of seed removal relied on devices that pinched the fiber between two surfaces, drawing it through the mechanism in such a way as to leave the seeds behind. Other methods existed of separating the lint from the seeds that produce it, and evidence remains of many ways to accomplish the task. The

"archetype" mechanism, however, involved active and passive elements, slim rollers over flat surfaces (p. 3). The expansion and integration of the medieval cotton economies had, by perhaps the twelfth century, led to gins composed of two moving rollers instead. In India, a worm gear turned two rollers "simultaneously but in opposite directions" (p. 11), while the Chinese used devices that employed two different power sources for the two rollers by the fourteenth century.

These roller gins developed in the context of a global trade dominated through the Levant by the Muslim empire. When Western Europeans attempted to bypass the middlemen in the spice-and-cloth trade between the Indian Ocean and the Mediterranean, their explorers sailed across the Atlantic and stumbled on the Americas instead. This error did not deter them from their original intent. Rather than develop a new trade route, they settled colonies to grow substitutes for commodities imported from the East. Cotton cultivation foundered on the mainland, where the production of tobacco, rice, indigo, and naval stores brought higher profits, but Caribbean planters continued to harvest the lint through the seventeenth century and, by century's end, "supplied more fiber to British textile makers than [had] the historic Levantine producers" (p. 21).

With the mechanization of cotton spinning in 1770s Britain, the increasing demand of manufacturers "pushed downstream change in gin design" (p. 21). The evolution of Caribbean roller gins had already led to impressive advances in both technological forms and outturn efficiency that Enlightenment philosophers, fascinated by machines, documented. Experimentation with gin design led to variations both in methods of seed removal and in power supply. In the first half of the eighteenth century, a foot gin that used flywheels to transmit the power of a foot-driven treadle to the rollers probably reached outturn of twenty-six to forty pounds per day (pp. 29, 45).

With British and domestic industrialization increasing in the 1770s, North Americans re-entered the cotton trade and adapted roller-gin technology to the increasing demand. Barrel gins that utilized a single crank to turn many pairs of rollers reached outturns of between 70 and 250 pounds per day, but the rate relied on skilled ginners feeding the fiber. These machines "increased outturn through iteration but ... did not increase ginner productivity," requiring "a great deal of skill, labor, and capital, perpetuating a preindustrial order as they imposed an industrial pace" (p. 38). This design served the Revolutionary nation's agrarian origins and industrial ambitions, but imposed vast hand-labor requirements typical of plantation production. Machines such as these required the strongest and smartest slaves to work the machines rather than the fields.

Roller-gin evolution culminated in 1788 when Joseph Eve, a Philadelphian raised and working in the Bahamas, invented a self-feeding gin that "uncapped outturn by eliminating the ginner" (p. 40). Using one person rather than the many who served the multiple rollers of the barrel gin, his device could clean 80 to 100 pounds of cotton, more than doubling the outturn of the single-person foot gin. It eliminated the hernias and miscarriages that foot-gin operation entailed. It also had the advantage of adaptability, as it could draw power from any external source, whether wind, water, steam, or muscle. Roller gins fed not only British industrialization but also a fledgling North American industry, both North and South.

In 1794, Eli Whitney broke from the roller-gin tradition, patenting a gin that used wire teeth to draw the fiber through a grate too narrow for seeds. This "new ginning principle ... privileged quantity over quality" by tangling and tearing the fiber while removing the seeds (p. 47). Of course this machine proved little use to anyone, but the dramatic outturn it achieved (he claimed 2,500 pounds per day using only two laborers) inspired new concentration both on roller gins and within

the framework of the new technique. One popular device replaced Whitney's teeth with circular saws that did similar damage to the fiber but eased installation and repair. In 1796, Hodgen Holmes received his own patent for this saw-gin improvement over Whitney's design.

Whitney and his business partner Phineas Miller responded to these developments with vigorous legal action, "a contentious and socially and legally mediated process from which Eli Whitney emerged as the inventor of the cotton gin" (p. 47). Miller filed twenty-five lawsuits over fifteen years, and the firm won the crucial contest against Holmes and his saw-gin patent. Miller waited years to file suit, meanwhile shipping Whitney's gins with saws or endorsing the replacement of their original teeth with the Holmes enhancement. Using "the ironies of adoption to his advantage," he ultimately received a nullification of Holmes's patent in 1800 (p. 68). Appeals that upheld the ruling used the history of the invention that Miller provided, which thereby became the history of the machine.

Lakwete devotes her first three chapters to these developments, then explores in four more the less dramatic but equally important aftermath of Miller and Whitney's legal victories. The roller gin did not disappear before Whitney's claims but continued evolving, and competition between the two methods persisted several decades into the nineteenth century. Here her ingenious research yielded detailed sketches of vast and regionally various networks and communities of gin makers, large firms and local mechanics. She scrutinized with care the various ways that gin makers and manufacturers utilized or worked around the Whitney patent to develop what became, by the 1820s, separate markets for roller and saw gins.

The two technologies yielded different products. Quality comparisons between the two found crushed seeds problematic in roller-ginned lint, while short, torn, troublesomely knotted fiber characterized the output of saw gins. The remarkable outturn rates of saw gins trumped the quality of roller-ginned cotton as the century turned. Yet, even in the triumph of the saw gin, context mattered as much as efficiency. During the Napoleonic Wars textile manufacturers, anxious about disruption in their raw-material supply, learned to accept as standard the difficulties of dealing with the plentiful Whitney-ginned staple. Even at midcentury, however, the roller gin remained the machine of choice for longer-staple sea island cotton that grew best along the southern coasts and found its niche in luxury markets (p. 75).

Attempts to develop roller gins for the short-staple cotton that flourished along with westward expansion continued well into the nineteenth century. The most notable of these was the McCarthy gin, an intricate and elegant machine patented in 1840. Though intended for short-staple growers, the machine could not bridge the gap between the saw- and roller-gin markets. Its inventor sacrificed the outturn quantity on which short-staple cultivators relied for quality that did not match that produced by barrel and Eve gins. Yet, the elegance of Fones McCarthy's design meant his gin was cheaper to operate and required less valuable laborers than the existing technological systems used by long-staple planters. When his machine replaced the once-dominant roller gins they were forgotten, perpetuating a myth: before Whitney, no gins existed.

Machines themselves were Lakwete's most important sources for this story, both artifacts which she found, identified, opened, and studied at far-flung museums, and the pictorial representations and descriptions of their workings lodged in patents and patent extension files, advertisements, and business records. Machines, however, provide the basis only for what historians of technology call internalist analysis: careful examination of apparatus evolution without reference to the external forces that both cause and reflect technological change. Lakwete's exhaustive research in newspapers, city directories, manu-

script census materials, court records, and the R. G. Dun & Company credit reports fleshed out the multiplicity of gins and gin-makers that existed before and after Whitney's invention. Throughout her study, she worked to pay particular attention to the human element of both gin designers and gin users, the slaves whose labor made gins work.

The book is a triumph, but a difficult read. Many readers will lose focus in Lakwete's intricate story, both the careful internalist scrutiny of machine evolution and the lengthy, detailed accounts of gin-makers, large and small, their strategies and communities, and their attempts to carve out markets for their individual products. Yet carefully chosen chapters--particularly the first three, "Cotton and the Gin to 1600," "The Roller Gin in the Americas, 1607-1790," and especially "The Invention of the Saw Gin, 1790-1810"--could provide a brilliant antidote to conventional wisdom for undergraduates or graduate students at any level, in American or world history surveys or more specialized courses on the U.S. South. Many different curricula would do well to incorporate one or another of these chapters into their assigned readings.

In addition, her eighth and concluding chapter, "Machine and Myth," movingly elaborates the reasons why the legend of Whitney's invention has persisted so long and penetrated so deeply into standard accounts of American history. It "triggers a vivid narrative" that "begins with inept planters and sleepy finger-ginning slaves and ends with battlefield dead" (p. 191). The simple phrase, "Eli Whitney invented the cotton gin," provides remarkable explanatory power. It takes responsibility for the course of southern history, indeed nineteenth-century American history, out of human hands. It lodges a multitude of individual economic and cultural choices in an invention, a technology that came from nowhere but one man's mind and had seemingly inevitable and tragic results.

Yet, time and again, Lakwete has let pass opportunities to address the literatures that her research has challenged and revised. Her essay on sources engages some scholarship as well as summarizing her methods and evidence, but the themes developed in the body of the work too often remain inadequately inflected in both text and notes. For example, she regularly evaluates southern inventiveness and the role of northerners in southern industrialization, as the story of the Yankee, Yale-educated Whitney would require. And she ends her essay with a nod to those who "reconcil[ed] the paradox of modernity and slavery by living it" (p. 222). But she rarely touches explicitly on long-running debates about the course of southern economic growth and slavery's impact on industrialization.[2]

In the historiography of technology too, now half-a-century old, Lakwete could have made important inroads and drawn on vigorous debates. The role of Phineas Miller, the inventor's business partner who spread Whitney's myth and made his machine work profitably, has precedents: Matthew Boulton played much the same part in James Watt's invention of the steam engine. Miller used his legal maneuverings as well to "test and refine patent law" (p. 67). This finding could fruitfully indicate the historical basis for scholars of technology who look at "patents as texts" and explore the histories of invention that patent-seekers present in dismissing predecessor technologies, inventors who tie up their competitors in legal battles while establishing their methods in the field.[3]

Jet engines might also have provided useful points of comparison with Whitney's gin, because turbojet flight differed so radically from the piston-engine propeller planes that preceded it. Outsiders to the air-flight engineers' community had to make them, and measurements of efficiency changed in order to judge them. Edward Constant's classic text on the subject explained with care the ways that revolutionary technologies

transform the standards by which output is measured. Although elements of his argument have been challenged by more recent scholarship, the tug-of-war between quality of cotton fiber and quantity of outturn that Lakwete uncovers speaks directly to his point.[4]

Perhaps most importantly, her story of the "continuity [that] marked the history of cotton and the gin in America" directly contradicts common assumptions about the sources of American economic growth in the nineteenth century (p. 71). Ginning was "not a bottleneck," she declares confidently and correctly at the conclusion of her analysis of pre-Whitney gin technology (p. 45), but she does not cite those scholars who have assumed otherwise. "[T]he bottleneck that called forth Whitney's gin" has served too long as the staple explanation for the sudden explosion of cotton production in the nineteenth-century South.[5] To technological determinism such as this, in which machines come from single acts of individual genius to cause significant social and economic changes--to accounts that rely on *machina ex deo* explanations of technological change, in which "the most significant invention" of the antebellum period "needs no extended description"--Lakwete has hopefully dealt a fatal blow.[6]

Notes

[1]. Thomas Edison's light bulb figured largely in Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983). Hughes, in his classic study of how large technological systems develop and mature, argued that electrification can best be understood as a system that includes artifacts ranging from hydroelectric dams to light bulbs to utility companies and, as any such system develops, an element that lags behind the rest (his famous concept, borrowed from military history, of a reverse salient) will draw the attention and work of systems-builders--hence the many competing designs for light bulbs that appeared in the late nineteenth century. Henry Ford's assembly line appears at the end of a long, bumpy, and indirect road to mass production in David A. Hounshell, *From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States* (Baltimore: Johns Hopkins University Press, 1984). Proponents of mass production and interchangeable-parts manufacturing techniques also struggled to establish their methods in Merritt Roe Smith, *Harpers Ferry Armory and the New Technology: The Challenge of Change* (Ithaca: Cornell University Press, 1977).

[2]. See, for example, Robert S. Starobin, *Industrial Slavery in the Old South* (New York: Oxford University Press, 1970); Fred Bateman and Thomas Weiss, *A Deplorable Scarcity: The Failure of Industrialization in the Slave Economy* (Chapel Hill: University of North Carolina Press, 1981); and Curtis J. Evans, *The Conquest of Labor: Daniel Pratt and Southern Industrialization* (Baton Rouge: Louisiana State University Press, 2001).

[3]. Geof Bowker, "What's in a Patent?," in *Shaping Technology/Building Society: Studies in Sociotechnical Change*, ed. Wiebe E. Bijker and John Law (Cambridge: MIT Press, 1992), pp. 53-74, quotation at p. 53.

[4]. Edward W. Constant II, *The Origins of the Turbojet Revolution* (Baltimore: Johns Hopkins University Press, 1980); see also Eric Schatzberg, *Wings of Wood, Wings of Metal: Culture and Technical Choice in American Airplane Materials, 1914-1945* (Princeton: Princeton University Press, 1999).

[5]. Gavin Wright, *Political Economy of the Cotton South: Households, Markets, and Wealth in the Nineteenth Century* (New York: Norton, 1978), p. 13.

[6]. Douglass C. North, *The Economic Growth of the United States, 1790-1860* (Englewood Cliffs: Prentice-Hall, 1961), p. 52.

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