THE EVOLUTION OF COTTON GINNING IN THE SOUTHEASTERN UNITED STATES

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Although Eli Whitney's cotton gin is often considered to be an invention that changed American history, few interpretive studies of cotton ginning exist. This lack seems curious when it is remembered that cotton gins are ubiquitous features on the landscape of the southeastern United States and are pivots in the production of one of the nation's most important agricultural commodities. The gin plant encompasses both the final stage of agricultural production and the initial stage of the manufacturing process.

The geographical aspects of cotton ginning in the southeastern United States are examined here in historical perspective. The industry is viewed in terms of three revolutions, or periods of rapid technological change in ginning. The first revolution occurred during the closing decades of the eighteenth century and the initial decades of the nineteenth. The second revolution took place after the Civil War, and the third revolution, still in progress, began in the 1940's. Each period of rapid change left traits that have combined to give the southeastern ginning industry its contemporary characteristics.

The First Ginning Revolution

Eli Whitney, rather than inventing the cotton gin, developed the second of two types. The first type evolved from the charkha, which originated in antiquity on the Indian subcontinent and consisted of a pair of wooden rollers mounted on a frame. As the rollers were turned with a hand crank, the cotton passed between them and the seeds were squeezed out. Roller gins that evolved from the charkha were used in North America at least as early as the 1740's.

The first North American roller gins were crude but effective. Their major disadvantage was a failure to work equally well in gin-
ning the two types of cotton known to the early settlers—black seed, or long staple, and green seed, or short staple. The smooth black seeds of the long staple did not adhere tightly to the fiber and therefore were removed rather easily by the roller gin. However, the growth of black-seed cotton was restricted to the South Atlantic and Gulf coastal fringes. Green-seed cotton had a much broader distribution, but its tightly clinging seeds were not effectively removed as the cotton passed between the rollers. Those who wished to raise cotton commercially were confronted either with finding a way to grow the black seed or with perfecting a method for ginning the green seed.

Throughout the 1700's numerous attempts were made to adapt the roller principle to green-seed cotton. These endeavors, together with efforts to improve the efficiency and the capacity of the roller gin for the black-seed variety, constitute the origins of the first ginning revolution.

James Marion, Joseph Eve, Baron von Krebs, Louis Prat, Robert Watkins, Eli Whitney, Claude Joseph du Breuil, and William Longstreet were among those who sought to perfect a cotton gin. In 1747 Marion claimed to have a machine that would “in the Space of twelve Hours, gin (clean from the Seed) eighty Pounds Weight of Cotton.” “Ingenious Mr. Joseph Eve” in 1790 demonstrated “a gin for cleaning cotton” that was “highly commended by every person who [saw] it at work.” In 1796 a roller gin that was “competent for cleaning cotton in the most expeditious manner without injuring the staple” was announced by Robert Watkins of Elbert County, Georgia. However, of all those who sought to perfect ginning, Whitney is the one remembered. Rather than attempting to improve the roller method, he invented a new principle in 1793 for removing the seeds. Whitney's gin contained a cylinder filled with wire teeth set in annular rows. As the cylinder was turned, the teeth drew the cotton into a breastwork of transverse grooves through which the lint passed, but not the seed.

Development of the Whitney machine meant that there were two

5 Georgia Gazette (Savannah), Feb. 5, 1791, p. 2.
Fig. 1—The pre-Civil War cotton gin. Source: D. A. Tompkins: History of Mecklenburg County and the City of Charlotte (2 vols.; Charlotte, N.C., 1903), Vol. 1, p. 119.

Fig. 2—A pre-Civil War cotton ginhouse near Columbia, South Carolina. Although these were made obsolete during the second ginning revolution, some continued in use into the first decade of the twentieth century. Few buildings of this type survive.
methods of ginning cotton, each with its advantages and disadvantages. The Whitney gin could easily clean either the green-seed or the black-seed cotton. Its chief advantage was speed: the larger, second-model Whitney gin reportedly could "clean ten times as much cotton as . . . in any other way known." But it shortened the staple by cutting many of the fibers and thereby lowered the price of cotton.

The first revolution did not conclude with the introduction of the Whitney principle. Presses for baling cotton, running gear for driving the gin, and buildings for housing the machinery were yet to evolve. A major improvement on the Whitney principle came quickly. In 1796 Hodgen Holmes was granted a patent for a gin in which sawlike teeth cut into iron disks replaced the spiked cylinder of the Whitney patent. This variation gained general acceptance and gave the name "saw gin" to the new machine.

Although modern roller gins are presently used in India, Pakistan, Egypt, and Sudan, and in certain other cotton-producing countries, the saw gin has dominated the United States cotton industry. Except in the now-extinct Sea Island cotton region and in the contemporary American-Egyptian cotton areas in the West, the roller gin was never accepted by the nation's cotton producers, despite several attempts to promote the machine after it was perfected.

THE PRE-CIVIL WAR COTTON GIN

Today the term "cotton gin" implies the entire integrated plant that dries and cleans seed cotton, separates the seed from the lint, and bales the fiber. Initially, however, the term referred only to the machine that separated the seed from the lint, now called the "gin stand." Most pre–Civil War gin stands were approximately six feet wide and twelve to eighteen feet long. The sixty-saw stand, which could gin three or four bales a day, was the most popular type.

8 Eli Whitney to his father, Sept. 11, 1793, in Eli Whitney Papers, Yale University, Sterling Memorial Library.

9 In 1804 long-staple cottons sold on the Charleston, South Carolina, market for 34 to 37 cents a pound, whereas green seed was quoted at 16.5 to 18 cents. Upland black seed that was roller ginned was quoted at 25 cents, whereas it brought only 18 to 22 cents when it was saw ginned (Charleston Courier, June 1, 1804, p. 2).

10 Mirsky and Nevins, op. cit. [see footnote 7 above], pp. 113–116.

11 In 1840 Fones McCarthy received a patent on a revolutionary type of roller gin. The McCarthy gin was adopted in the Sea Island cotton region and is now used in the American-Egyptian cotton regions of the West. McCarthy gins are also used in other parts of the world, including the Indian subcontinent and eastern Africa. Recent developments in roller ginning are discussed in Charles A. Bennett: Roller Cotton Ginning Developments (Dallas, The Texas Cotton Ginters' Assn., 1960?).
Although public ginneries existed from the beginning of commercial cotton culture, ginning was primarily a plantation activity before the Civil War. A planter established a gin plant by purchasing the gin stand, the running gear, and the baling press and by building a structure to house the machinery. The typical ginhouse was a two-story wooden building (Figs. 1 and 2). The lower floor contained the running gear, the chief component of which was a large wheel propelled by four horses or mules. The outer edge of the wheel had cogs which geared it to a spur wheel connected by a leather belt to the gin stand on the floor above. Ginned cotton was discharged into the lint room, which was situated either behind or below the gin stand.

The fiber was carried in baskets from the lint room to the baling press a few yards from the gin house. There, horses hitched to long sweeps turned a screw to compress the bales. Bales weighed between 400 and 500 pounds and were covered with hemp bagging. Rope was originally used to bind the bales, but by the 1850's iron bands were replacing it.

Preparation of cotton also included cleaning trash from the fiber, primarily by hand picking. Among the early improvements in gins were devices for extracting foreign matter.\(^\text{12}\) Machines also were devised for cleaning cotton before it was taken to the gin stand. One such “trasher” was a long wooden cylinder with a wire grating on the underside. When the pegged shaft that extended through the cylinder was turned, the beating action caused the trash to fall through the grating.\(^\text{13}\) If the cotton was damp, preginning preparation included drying, an operation usually accomplished by spreading damp seed cotton on outdoor racks.

Saw gins were manufactured by local craftsmen almost from the introduction of the Whitney gin. Each artisan introduced slight innovations, and as time went on, certain manufacturers became famous for their improvements. Most gins, such as the Brooks and the Cunningham, were used only in the vicinity of their manufacture. Others, such as those produced by Pratt, Griswold, Gullett, and Brown, were widely sold. In 1860 there were fifty-seven manufacturers of cotton gins in the United States. All were small, and all but three were in the cotton regions. Of the fifty-seven manufacturers, thirty-four employed

\(^{12}\) For example, Eleazer Carver added “moting bars” to his gins. These devices removed trash and immature seeds (motes) (Charles A. Bennett: Saw and Toothed Cotton Ginning Developments [Dallas, The Texas Cotton Ginners' Assn., 1960?], p. 27).

\(^{13}\) B. L. C. Wailes: Report on the Agriculture and Geology of Mississippi (1854), pp. 170-179.
fewer than ten workers and thirty-one sold less than $10,000 worth of cotton gins annually. The largest factory, operated by Daniel Pratt at Prattville in Autauga County, Alabama, built more than 8000 gins between 1833 and 1860. In 1860 his operation employed sixty-six workers and produced gins valued annually at $289,000.14

THE SECOND GINNING REVOLUTION

The Civil War was a major break in the historical and economic evolution of the southeastern United States. Following the war, alterations occurred in methods of growing and marketing cotton. Small plantation gins declined in importance, and public ginneries gained acceptance during the latter part of the nineteenth century. This constitutes the second revolution in cotton ginning.

Changes in the plantation system were the most important of the factors that altered ginning operations. Under the prewar system, the slave work force had been closely supervised. Labor inputs had been carefully regulated and integrated into all phases of cotton production, from plowing in the spring through ginning in the autumn. The plantation cotton gin with its relatively large labor requirements was fitted into this system. Cotton was gathered on sunny autumn days and was stored; on inclement days the slave force undertook the ginning.

With emancipation a tenant-labor system replaced the slave system on cotton plantations. The freedmen were supervised almost as closely as before, but they sought to express their liberty. Amenity requirements altered field and settlement patterns.15 Another expression of freedom affected cotton ginning: whereas on the pre–Civil War plantation the entire cotton crop had belonged to the landowner, under rental agreements each tenant owned a half to three-fourths of the cotton he grew. Quality control deteriorated, for a plantation's cotton crop no longer could be sorted carefully on the basis of color and trash content before ginning. Furthermore, tenants could not be brought together easily to operate the cotton gin.16

Immediately after the Civil War large public gin plants were rec-

14 "Manufactures of the United States in 1860: Compiled from the Original Returns of the Eighth Census" (Washington, 1865), p. ccxvi.


ommended. In the 1866 "Report of the United States Commissioner of Agriculture" one correspondent commented:

Another radical modification of the former [prewar plantation] system, which ought to be made immediately, and which would give to cotton-growing an impetus which it could derive from no other source, is the building of neighborhood gin-houses in well-chosen locations, so as to be central to large farming communities. These mills should be propelled by steam, and furnished with the best of apparatus for ginning and baling cotton, and also for extracting oil from cotton seed. The existence of such a mill within the distance of five miles would be a strong inducement to the small farmer and the poor immigrant, from the northern States or from Europe, to engage at once in the planting of cotton.17

A special report on cotton production conducted under the direction of Eugene W. Hilgard as part of the 1880 census reveals the changes that took place during the years immediately following the war. From the Georgia Piedmont one observer reported that "before the civil war every considerable planter kept a gin of his own. Many of these gins have now fallen into disuse, and much of the ginning is done by those who make a business of it, and whose gins are run by water—or by steam-power."18 And another stated that "steam-gins are used by the wealthier farmers, to whom others of the neighborhood haul their seed-cotton to be ginned. . . . This practice, both in this [Clarke County] and surrounding counties, was made necessary by the great increase of small farms."19

Although the need for major changes in ginning was generally recognized, efficient public cotton gins evolved relatively slowly, as technological innovations decreased labor requirements. In the first stages of their development—the beginning of the second ginning revolution—plantation gins were modified. Initially cotton was fed by hand into the gin stand, but soon a mechanical "feeder" was developed. Whereas in the typical pre-Civil War ginhouse the lint fell from the gin stand into the lint room, in the 1860's a "condenser" was perfected to receive cotton in a box that was easily carried to the press. Although a few steam-powered cotton gins had been built before the war, horse- and mule-powered plants were increasingly modified by the addition of steam engines after 1865.20

19 Ibid.
Dissatisfaction with the first public gins was widespread. One observer noted that they "spring up everywhere" and that generally they were "cheaply and very poorly constructed." Dissatisfaction with the first public gins was widespread. One observer noted that they "spring up everywhere" and that generally they were "cheaply and very poorly constructed." A principal point of contention was related to the deterioration of the quality of ginned cotton. Calling the cotton gin "the pivotal point around which the whole manufacture of cotton revolves," Henry Grady, foremost advocate of an industrial New South, estimated in 1881 that improvements in ginning could add $30 million annually to the value of the cotton crop. This increased value could be achieved by removing greater amounts of dust and trash and by reducing labor costs through the construction of large gin plants.


22 Henry W. Grady: Cotton and Its Kingdom, Harper's New Monthly Magazine, Vol. 63, 1881, pp. 719-734; reference on pp. 728-730. Interestingly, Grady thought that part of the increased income could be achieved by use of the McCarthy roller gins, which he considered capable of surpassing "in quantity of cotton ginned as well as quality of lint" the "rude and imperfect saw gins."
Fig. 4—The ginning system. Source: Tompkins: Cotton and Cotton Oil (see text footnote 16 for reference), p. 83.

Fig. 5—An abandoned single-battery, two-story cotton-gin building in Union County, South Carolina. This was the typical cotton-gin structure of half a century ago, and as recently as 1945 a quarter of the nation's cotton gins were housed in such buildings. Many of them remain, but only a few contain operative machinery.
Although the addition of feeders, condensers, and steam engines saved labor, cotton ginning still required much effort, and the typical public gin produced only six bales of cotton a day, compared with three or four processed by the old plantation gins. Transfer of seed cotton from the wagons to the storage bins, from the storage bins to the feeder, and from the condenser to the press required large amounts of labor.

During the first ginning revolution innovators sought to save labor by perfecting the cotton gin; during the second revolution they sought to save labor by automating the movement of cotton from the wagon to the gin stand and from the gin stand to the press. A revolving spiked belt was among the new methods for transferring cotton from the wagon to the ginhouse (Fig. 3). The belt carried seed cotton to the top floor of a three-story building, where workers pushed the cotton into feeders of gin stands located on the second floor. Other laborers transferred the lint from the gin stands to the press. Although such an arrangement was an improvement, ginning remained cumbersome and labor consuming.

Robert S. Munger, of Mexia, Texas, made the most important contribution to the second revolution. Between 1883 and 1885 he developed a “ginning system” whereby cotton was moved by air, gravity, and belts from the time it left the wagon until the bale of lint was “tied-out” at the press (Figs. 4 and 5).23 An air-suction system raised the seed cotton from the wagon to a device termed the “separator,” which removed some of the trash. A belt then delivered it to the feeders of a battery of three or four gin stands. The feeders cleaned the fiber with a whipping action similar to that of the cruder trasher. Air moved the ginned lint to a large condenser; from there it fell into the press box and was packed down by a steam-powered tramper. To permit continuous ginning, Munger devised a revolving double-box press. When one box was filled with enough cotton for one bale, the boxes were rotated. The full box came to rest over an up-packing compression ram, and the other one moved into position to receive the cotton for the next bale.

In addition to its other advantages, a four-stand Munger ginning system easily produced twenty-four to thirty bales of cotton in the time it took the modified plantation gin to process six.24 Although

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24 The Cotton Plant [see footnote 21 above], pp. 358–360.
many improvements have been made, the basic movement of fiber through a gin plant is still that of the Munger system; its development marked the emergence of the modern cotton gin.

**Consequences of the Second Ginning Revolution**

The revolutionary ginning system did not break completely with the past, for existing machinery was incorporated into it. The two-story design, with gin stands on the second floor and the drive mechanism below, was a definite carryover. The two-story arrangement, however, had disadvantages, which led to other building designs; for one thing machinery on a second floor increased vibration. About the turn of the century, a one-and-a-half-story gin plant was introduced, in which the gin stands were on the ground floor, and one end of the building had an elevated platform to accommodate the up-packing press (Fig. 6). But the one-and-a-half-story design never completely superseded the two-story arrangement, which continued to be built as late as the 1930's. In a two-story building, the hazardous drive mechanism was below the main work area, and many ginners considered this desirable. Moreover, some felt that the elevated press platform of the one-and-a-half-story building was a greater disadvantage than the vibration was, because of the steps that had to be climbed.

Several arrangements were employed in order to locate all machinery on the ground floor. In one arrangement the lower part of the press was placed in a pit. Although many cotton gins of this type were constructed, they had disadvantages associated with water seepage in the pit and with repair of the lower part of the press. A satisfactory solution to the problem came with the development of a press that packed down rather than up, permitting all machinery to be on one floor.

In addition to machinery arrangements, the number of gin stands and the type of building material used influenced design. The length of a building was related to the number of gin stands in the battery. Width was influenced by the number of batteries of gin stands (Fig. 7). Most plants had only one, although double-battery cotton gins were common in towns. The majority of the gin buildings were constructed of wood, brick, or corrugated steel on a wood frame. Brick and corrugated steel buildings were the most common types in towns. Rural cotton gins were usually of wood or corrugated steel.
Fig. 6—An abandoned one-and-a-half-story cotton-gin building in Marshville, North Carolina. The design of the building permitted the gin stands to be on the ground floor and an up-packing press to be on the floor above. In 1945, 40 percent of the cotton-gin buildings were of this type.

Fig. 7—Monroe Gin and Fertilizer Company, Monroe, Georgia. The two-story building was constructed about 1900 to house a double-battery cotton gin that was part of a cotton-oil and fertilizer-manufacturing complex. The ginned cotton was removed through a door at the end of each battery. The building now contains a modern, one-battery cotton gin.
The introduction of the large ginning system had an impact on the number of cotton gins. But, unfortunately, the first attempt to enumerate cotton gins was not made until the census of 1890. In 1889 only 1637 gin plants were reported in the United States, clearly fewer than the actual number as later revealed. In 1899 the Census Office began to collect data on the cotton crop using reports filed annually by ginners (Fig. 8). The main objective was to determine the number of bales produced, but this required knowing the number of active and idle gin plants.

Although the greatest number of active cotton gins (30,948) was reported in 1902, the maximum was apparently reached earlier, when system ginning was introduced. Daniel C. Roper, originator of the "Census Office Cotton Report" (and later Secretary of Commerce under Franklin D. Roosevelt), wrote in 1903 that replacement of "the

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old plantation ginnery by larger public establishments . . . [had] progressed so rapidly during the past five years that the number of small ginneries . . . [had] decreased more than fifty per cent."²⁷ By 1905 the number of cotton gins had declined to 28,757. The rapid technological changes that had occurred during the second revolution are illustrated by the fact that only 587 of these gins were propelled by animals and 1905 by water. Almost all of the others were driven by steam engines. Approximately half had more than one gin stand.²⁸ Most multistand plants probably employed a ginning system.

Perhaps the most significant change during the second revolution was that ginning became less of a plantation-oriented operation. Although farming continued to be the most important activity associated with ginning, a host of ancillary enterprises evolved. The "furnish" businesses were the most important of the new activities. Poverty, absence of adequate banking facilities, and lack of a sufficient supply of currency in the post–Civil War South contributed to the development of a system of agricultural credit in which furnish merchants advanced food, fertilizers, implements, and other necessities to farmers in the spring and took liens on crops as security. However, the merchants, who in turn had their creditors, accepted liens only on crops, such as cotton, which had well-established markets.

The new gin plants were frequently owned by firms that bought and crushed cotton seed, mixed and sold fertilizers, or purchased and stored cotton. Most of these companies were local, but a few, such as the American Cotton Oil Company, were large, multifaceted regional and interregional corporations.

The cotton-oil industry is the significant by-product business related to cotton production. It did not rise simultaneously with cotton culture but became important during the last decades of the nineteenth century. Development of the industry at the time of the second ginning revolution was not accidental. Centralized cotton gins aided in the efficient collection of seed. In 1881, shortly before the development of the ginning system, Henry Grady remarked that the oil mills then in operation were "unable to get enough [seed] to keep them running." He attributed this problem to the fact that cotton


was “ginned in such awkward distribution, and in such small quantity at any one locality” that seed could not be “gathered promptly or cheaply enough for the oil mills.”

The cotton-oil industry in turn had an impact on the ginning industry. Throughout the cotton regions some of the new gin plants either were owned or were controlled by oil mills. Nearly all of the oil mills, except those in larger towns and cities, had cotton gins at the mills, and many owned additional gins in the surrounding countryside. The cotton gins located at oil mills were among the largest in the Southeast; many were double- or triple-battery plants. The number of cotton gins controlled by oil mills cannot be determined accurately, but it is doubtful that the number ever exceeded 10 percent. However, because of their sizes and strategic locations, especially in market towns, the relative importance of cotton-oil mill gin plants was greater than their number suggests.

The manufacture and sale of fertilizers also became integrated with public gin plants. Under the prevailing credit system, farmers obtained fertilizers in the spring; payments were due in the autumn upon sale of the crops. Occasionally, fertilizers were sold on the cotton-option plan, under which a farmer agreed to pay either a specific amount of money or a specific amount of lint (for example, $25 or 300 pounds) for a ton of fertilizer. After considering the price of the cotton in the autumn, the farmer had the option of paying for the fertilizer at either the agreed cash or the lint price.

Passage of the United States Warehouse Act in 1916 created a system of private cotton warehouses that were federally regulated. The act stimulated construction of new warehouses across the Southeast, especially in the Carolinas, Georgia, and Alabama, where almost every town had at least one storage facility integrated with a cotton gin. Activities of lesser importance also became associated with cotton ginning. Some ginning firms manufactured ice in summer and sold coal in winter to provide employment for workers. Other firms had gristmills and sawmills, and a few marketed farm implements.

Sizes of the new public cotton gins and levels of integration of ancillary businesses varied, but by 1910 cotton ginning was not the simple activity that it had been in 1860. Under the umbrella title of “cotton ginner,” one usually encountered a cluster of business activities in which the gin, though central, was not always monetarily dominant.

29 Grady, op. cit. [see footnote 22 above], p. 727.
THE EVOLUTION OF COTTON GINNING

THE THIRD GINNING REVOLUTION

Changes during the second ginning revolution were so sweeping that Daniel A. Tompkins, promoter of cotton-gin improvements and patron of the industrial New South, was inspired to write that "the spirit of enterprise, invention, and improvement in the people of the South" had been revived and that "the entire method and all the machinery and appliances for preparing cotton for market" had been revolutionized. He added that the "most expensive item . . . left in the production of cotton [was] . . . the cost of picking the fiber from the stalks in the field."31

The dream of devising a mechanical harvester was almost as old as commercial cotton production. At the time of the second ginning revolution, the perfection and acceptance of satisfactory harvesting machines were still in the future. However, the widespread adoption of mechanical harvesters after World War II triggered another revolution in cotton ginning. The cotton gin of 1945 is as obsolete compared to a modern plant of the 1970's as the pre-Civil War plantation gin was compared to the ginning system of 1900.

The perfection of mechanical harvesters culminated decades of effort. Most innovators had sought to gather cotton by one of five methods: threshing, pneumatic suction, electrical attraction, spindle picking, and stripping. Each method had its advantages, and any could probably have been developed. Interest, however, centered on spindle picking and stripping. Picker harvesters pulled the seed cotton from the open bolls with revolving spindles, and strippers removed the entire boll either by combing the plant between teeth or by drawing it between stationary slats.

### Table I—Percentage of United States Cotton Crop Harvested by Machine, 1949-1968

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Source: United States Department of Agriculture, Consumer and Marketing Service (formerly Production and Marketing Administration).

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The initial patent for the spindle picker was issued in 1850 and for the stripper method in 1871. Despite the early invention of the two machines, stripper harvesters were not manufactured commercially and spindle pickers were not perfected to a level where a farm-implement company was ready to introduce trial machines until the late 1920's. Farm use of mechanical harvesters, however, was delayed two more decades. By 1946 only 1082 stripper harvesters and 107 spindle pickers had been manufactured in the United States. As recently as 1950 the percentage of the nation's cotton harvested mechanically was quite small (Table I).

Several factors retarded acceptance of mechanical harvesters. The intensive nature of traditional cotton production demanded large labor inputs integrated into three distinct operations, plowing, weeding, and harvesting. In plantation areas management had little incentive to reduce labor requirements for harvesting because a large labor force was still needed for the other two operations. In yeoman farmer areas small-scale operations and subsistence agriculture presented almost no market for mechanical harvesters. Furthermore, an anti-laborsaving-machine attitude prevailed throughout the nation during the depression of the 1920’s and 1930’s. Social scientists and federal officials were becoming concerned with the human factors in the national economy, and during the 1930’s rural poverty in the cotton regions suddenly attained the status of a national problem. Because some believed that tractors and mechanical cotton harvesters threatened more unemployment in a time of general unemployment, warnings about the consequences of mechanization were issued.

Nonetheless, the difficulty in ginning cotton gathered with machines was the principal factor that held back the mechanical harvesters. Machine-harvested cotton has a higher moisture and trash content than hand-harvested fiber. Although the ginning system could extract a limited amount of trash and partly dry the cotton with air, it was not capable of efficiently ginning fiber gathered by mechanical harvesters. For this reason, developers of stripper harvesters and spindle pickers devised methods of cleaning seed cotton before it was taken to the gin plant, a tactic reminiscent of practices on plantations before the Civil War. However, cleaning devices attached to strippers added to the weight of these cumbersome machines. Separate cleaners

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33 Ibid., pp. 115 and 123.
used in the field or at the gin plant required additional labor and increased costs. By the early 1940's it was recognized that cleaning and drying machines would have to be incorporated into the ginning operation rather than into the harvesting.

Although in 1945 only a fraction of the nation's cotton was harvested mechanically, efforts were under way to design gin plants for machine-harvested fiber. As early as 1926 the United States Department of Agriculture had begun research on the problem of drying cotton, and by the early 1930's a seed-cotton drier had been developed. During the 1930's and the 1940's these auxiliary devices were increasingly added to gin plants. In 1945, 3093 of the 10,836 cotton gins in the United States had seed-cotton driers.

To facilitate removal of trash, additional cleaning equipment was installed above the gin stands. Burr machines removed cotton-boll hulls and large bits of trash. Impact cleaners extracted more trash and motes. Although such machinery greatly reduced the trash content of seed cotton, it failed to extract pepper trash, which remained in the lint after it left the gin stands. This problem was largely overcome by lint cleaners perfected during the late 1940's. These machines, which are installed between the gin stands and the press, are now considered essential.

By the early 1950's another factor related to mechanical harvesters began to affect the ginning industry. The harvest season for hand-picked cotton had commenced as soon as the first bolls ripened in late summer and had continued until late autumn or early winter. Now, because mechanical pickers are not taken into fields until most of the bolls are open, their use has compressed the harvest season into a few weeks. The Yazoo Basin of Mississippi, where the percentage of mechanically harvested cotton rose from practically 0 in 1944 to almost 100 in 1969, exemplifies the compression of the harvest season. In 1944, 12 percent of the area’s cotton was harvested before September 16, 36 percent between September 16 and October 18, 29.2 percent between October 18 and November 14, and 22.8 percent after No-

34 Charles A. Bennett: Handling Mechanically Harvested Cotton at the Gin, Cotton and Cotton Oil Press, Vol. 46, No. 13, 1945, pp. 5-8; reference on p. 5.
November 14. During the 1969 season, less than 1 percent of the crop was gathered before September 16 and only 5.6 percent after November 14. The rest was harvested between September 16 and November 14; nearly half during the first seventeen days of October.37

Gin plants were capable of processing handpicked cotton almost as quickly as it was harvested, but the compression of the harvest season from three to four months into a few weeks resulted in the arrival of more cotton than could be processed daily. Two possible solutions to the problem of insufficient capacity were either to store seed cotton or to increase the capacity of the gins.

Storage of seed cotton is not an innovation. In the pre–Civil War era cotton that was harvested during warm, sunny weather was stored for ginning on cold, rainy days. Later, many of the large public gins had special sheds for seed cotton in case the fiber arrived faster than it could be processed. But handpicked cotton usually was relatively dry and did not contain green plant matter, so it stored well. The high moisture content of mechanically harvested cotton, however, prevents storage for long periods. Although methods for satisfactory storage have been sought, most farmers still prefer to gin their pickings as soon as possible. For this reason, the capacity problem has been solved primarily by increasing ginning capability rather than by storage.

Increasing the number of gin stands in a plant was one way to increase capacity. It was also possible to construct plants with two and even three batteries of stands. But the addition of gin stands to a battery was efficient only to a point, and using more batteries increased labor costs because more laborers were needed.

During the third revolution volume was increased by enlarging the capacity of the gin stands rather than by increasing their number. This was accomplished by adding more saws and by enlarging saw diameters. Most of the cotton gins of 1945 had either 70- or 80-saw stands; in the early 1950's, 90-saw stands, which increased the ginning capacity by 30 percent, were introduced.38 During the late 1950's and the 1960's, manufacturers perfected stands with 100 or more saws and increased the saw’s diameter from 12 to 16 or more inches. The typical gin plant of the mid-1940's with four 80-saw stands could process a bale of cotton in approximately fifteen minutes. Modern high-capacity plants can gin a bale in three to eight minutes.

38 Smith, op. cit. [see footnote 23 above], p. 99.
THE EVOLUTION OF COTTON GINNING

Fig. 9—Bostwick Gin Company, Morgan County, Georgia. The building changes during the initial stages of the third revolution are seen in the contrasts between the 1910 two-story cotton-gin structure (left) and the one-story building erected in 1950 (right). This larger, higher building was needed to house drying and cleaning machinery developed during the 1940's.

Fig. 10—Farmers Home Gin Company, Colbert County, Alabama. This building, an end-product of the third ginning revolution, is typical of structures erected during the 1960's to house modern, high-capacity cotton gins. The gin plant can process a bale of cotton in less than five minutes. Four suction pipes (located under the canopy) lift seed cotton from trailers.
Fig. 11—A large ginning complex in a rural setting in the Yazoo Basin of Mississippi. The cotton gin (left) is a modern, high-capacity plant. The other buildings are for the storage of cotton seed and ginned cotton. Note the amount of space allotted for large trailers with unginned cotton and the hard-surfaced road. (Photograph courtesy of the National Cotton Council of America.)

Fig. 12—Tate County Farmers Gin Company, Senatobia, Mississippi. This one-story structure, erected in the late 1930's, is typical of many gin buildings in the Southeast that were enlarged to accommodate new equipment.
Consequences of the Third Ginning Revolution

Introduction of seed-cotton driers, auxiliary cleaning machinery, and larger gin stands have changed the morphology of gin buildings. Since more space for machinery was required, buildings constructed during the 1950's and the 1960's were longer and wider than the ones erected in the 1940's (Figs. 9 and 10). In addition, although one story in design, the new buildings were higher than the traditional two-story structures. Many existing plants were modernized by installing auxiliary machinery and new gin stands (Fig. 11). In such cases original lines were changed by additions to the buildings for new equipment.

More parking space also was required to accommodate the larger cotton trailers of the machine era (Fig. 12), and this was especially hard to acquire in towns, where land for expansion was limited. Towns that in Henry Grady's time considered the construction of large cotton gins within their boundaries as a sign of industrial advancement began to view them as liabilities. Lack of space for expansion, combined with noise and air pollution, has discouraged the erection of modern cotton gins within towns, and some in-town plants have been moved to the edges of the built-up areas.

Increased capital costs were another consequence of changes in cotton-ginning machinery. In 1940 a new cotton gin incorporating the latest machinery could be built for approximately $35,000. In 1948 a plant equipped to process machine-harvested cotton, but with the same ginning capacity as in 1940, cost about $100,000.39 A modern, high-capacity cotton gin costs more than $250,000.40

The amount of cotton that a gin plant must receive for its economic support is related to invested capital and costs of operation. Rising capital investments and problems of achieving economies of scale have increased the size of cotton-gin service areas during the past twenty-five years. The area from which a gin plant draws cotton must be large enough and have sufficient density of production to support the plant, but it must be small enough to permit economical transportation of the fiber to the cotton gin.41

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41 An analysis of the economics of cotton-gin location is contained in Charles D. Covey and James F. Hudson: Cotton Gin Efficiency as Related to Size, Location and
the size of cotton-gin supply areas in a region would be adjusted to capital investments and to operation expenditures of the plants so that maximum profits from ginning would be achieved. As rationalized by Lösch, service areas of adjacent plants would not overlap (Fig. 13A). It is doubtful if the ideal situation has ever been achieved. Traditionally, ginning capacity has been greater than needed to process the cotton crop. Cotton-gin service areas have been smaller than the sizes dictated by economics of transportation, and the areas have overlapped (Fig. 13B).

Cotton Production Density in Louisiana, Louisiana State Univ. Agricultural Experiment Station Bull. 577, Baton Rouge, 1963.

42 In 1940 South Carolina had approximately twice the ginning capacity needed (James M. Stepp: Cotton Ginning Equipment and Its Utilization in South Carolina,
Fig. 14—Active cotton gins, 1944. *Source:* Cotton Production in the United States, Crop of 1944 (see text footnote 37 for reference), pp. 10-23.

Fig. 15—Average number of bales per cotton gin, 1944. *Source:* Cotton Production in the United States, Crop of 1944 (see text footnote 37 for reference), pp. 10-23.
Each of the three eras of cotton ginning has been characterized by gin plants with different size service areas (Fig. 13C). The simple plantation-oriented cotton gins of the first revolution serviced areas with radii of a mile or two. Cotton gins of the second revolution represented greater capital investments, had higher ginning capacities, and serviced larger production areas, with radii between two and six miles. Whereas to operate economically the pre–Civil War cotton gins needed 100 to 250 bales annually, the public gin plants of the second revolution required 500 to 1500 bales. Developments during the third revolution caused service-area changes similar to those that were produced by the second revolution. Larger capital investments in cotton gins necessitated larger volumes. A modern gin plant requires between 3000 and 10,000 bales a season.

The principal factor that affects a farmer’s choice of a cotton gin is distance of his farm from the gin plant, but during the third revolution, as during the second revolution, this factor decreased in importance. Modernized cotton gins have expanded their service areas at the expense of plants without up-to-date equipment. Large trailers pulled by tractors or trucks over hard-surfaced roads now allow cotton to be transported economically more than twenty-five miles. Farmers have begun to bypass antiquated cotton gins in order to reach ones that have incorporated technological advances.

Owners of obsolete plants have been forced to meet competition either by modernizing their cotton gins or by building new ones. Their only alternatives have been to continue ginning with substantially reduced volumes or to suspend operations. Because of the large capital outlays and the large cotton volumes that are required for modern plants, many have closed their cotton gins. In certain instances, however, auxiliary enterprises have kept obsolete plants operating. A complex of cotton-related businesses may make a profit while the ginning enterprise loses money.

The decline in the number of cotton gins that began at the turn of the century has never ceased. The 1919 total of 18,400 had dropped to 9470 by 1944, a 49 percent decrease (Fig. 8). During the third revolution, the rate of decline has accelerated. Between 1944 and

South Carolina Agricultural Experiment Station of Clemson Agricultural College Bull. 362, Clemson, 1945, pp. 41-42). It is estimated that in 1961 Washington County, Mississippi, had an excess ginning capacity of approximately 1600 bales a day (Chester M. Wells, Jr.: Channels and Costs of Moving Cotton from Farms to Mills, Yazoo-Mississippi Delta, Mississippi State Univ. Agricultural Experiment Station Bull. 706, State College, 1965, p. 12).
1969 the number of gins decreased 58 percent, leaving 3943 active gin plants in the United States.

In the Southeast two principal factors have influenced the number and distribution of cotton gins since the end of World War II: the shifts in cotton production and the impact of the third ginning revolution. In 1944 cotton production in the Southeast was concentrated in seven major regions: the inner coastal plain of Georgia and the Carolinas; the Georgia-Carolina Piedmont; northern Alabama; the Mississippi Valley; the Black Waxy prairies of northern Texas; the south Texas coastal plain, including the lower Rio Grande Valley; and the high plains of southwestern Oklahoma and western Texas. The distribution of active cotton gins in 1944 reflects these major regions (Fig. 14). The relationship between cotton gins and cotton production in 1944 is perhaps best revealed by regional patterns of the average number of bales per cotton gin (Fig. 15). The average number ginned

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Fig. 17—Active cotton gins, 1964. Source: Cotton Production in the United States, Crop of 1964 (see Figure 16 for reference), pp. 12–27.

Fig. 18—Average number of bales per cotton gin, 1964. Source: Cotton Production in the United States, Crop of 1964 (see Figure 16 for reference), pp. 12–27.
in the major cotton regions was above the 1210 bale average for the Southeast as a whole.

Reimposition of federal crop allotments after World War II contributed to the decline of cotton acreage in the Southeast from 18.4 million acres in 1944 to 12.6 million acres in 1964. Despite this 32 percent decrease in acreage, the amount of cotton in the Southeast as a whole was greater in 1964 than in 1944. Improved techniques resulted in higher yields per acre, and production increased from 11.2 million to 12.1 million bales. However, during the two decades following World War II dramatic areal shifts occurred in both acreage and production. By 1964 the Piedmont had disappeared as a cotton region, and portions of the Black Waxy prairies were on the brink of desiccation as significant producers of cotton. In southern Mississippi, eastern Oklahoma, and certain other areas marginal to the principal cotton regions the crop also experienced dramatic declines. Decreases in acreage and production resulted in corresponding decreases in the number of cotton gins (Fig. 16).

While cotton declined in certain areas of the Southeast, both acreage and production increased on parts of the inner coastal plain of the Carolinas, Georgia, and Alabama, on the south Texas coastal plain, and on the high plains of western Texas. Except on the inner coastal plain, where increments were moderate, expansion was sufficient to justify increases in the number of gin plants, contrary to the trend of decline in the southeast as a whole.

Coexistent with the changes in numbers and distribution of cotton gins produced by shifts in cotton production were the changes brought by the third ginning revolution. The amount of cotton produced in the Mississippi Valley and certain other regions increased between 1944 and 1964, but dramatic declines occurred in the number of cotton gins, as high-capacity cotton plants replaced obsolete ones. In waning cotton regions such as the Piedmont, the gin plants that incorporated technological advances were able to expand their service


45 Increases in cotton acreage in one area had to be paralleled by acreage declines elsewhere, because cotton acreage is controlled by federal allotments. For example, acreage increases on the inner coastal plain of the Carolinas, Georgia, and Alabama were made possible by the transfer of the Piedmont's allotments (William A. Imperatore: Effects of Federal Controls on the Basic Geographic Characteristics of Cotton Production in Georgia [unpublished M.A. thesis, Department of Geography, University of Georgia, 1963]).
areas and to compete more successfully than obsolete plants for the cotton that remained. Although the number of cotton gins increased on the high plains of western Texas, plants that existed at the beginning of the third revolution continued to attract customers only if they installed the latest ginning equipment.

The distribution of cotton gins in 1964 again reveals the patterns of cotton production, but the map of the average number of bales per cotton gin in 1964 shows the lack of adjustment of number of gin plants to production in certain areas (Figs. 17 and 18). Between 1944 and 1964 the average number of bales per cotton gin more than doubled, increasing from 1210 to 2735 bales. The five viable cotton regions—the inner coastal plain, northern Alabama, the Mississippi Valley, the south Texas coastal plain, and the southern high plains—were the principal areas in which the average number of bales per cotton gin was above 2735. Satisfactory adjustments in the number of gin plants to cotton production by 1964 had failed to develop on the Piedmont and the Black Waxy prairies. Both areas were experiencing difficulties making the third ginning revolution transition. Compared with the viable regions they were oversupplied with cotton gins, many of which were obsolete.

The contemporary cotton ginning industry in the southeastern United States is complex. It is a product of evolutionary processes in which economic, technological, political, and other factors have had influences. Even the simplest visual expressions, cotton-gin buildings, convey inconsistencies of age, form, and function. Once the evolution of the industry is understood, the seeming hodgepodge can approach spatial order.

Although the third revolution in cotton ginning is drawing to a close, a fourth era of dramatic change—or perhaps it is merely a continuation of the third—seems imminent. In order for cotton to survive as a commercial crop in the Southeast, more extensive production methods will have to be developed. Experiments in new methods of planting and harvesting are under way. In addition, methods of ginning and marketing cotton will have to be improved. Perhaps the cotton gin of the future will be a large central plant that operates throughout much of the year, draws cotton from a 50- to 150-mile radius, and processes more than 50,000 bales annually. Such a plant could lower ginning costs and control quality more adequately. If this is the cotton gin of the future, fewer than 300 will be needed.