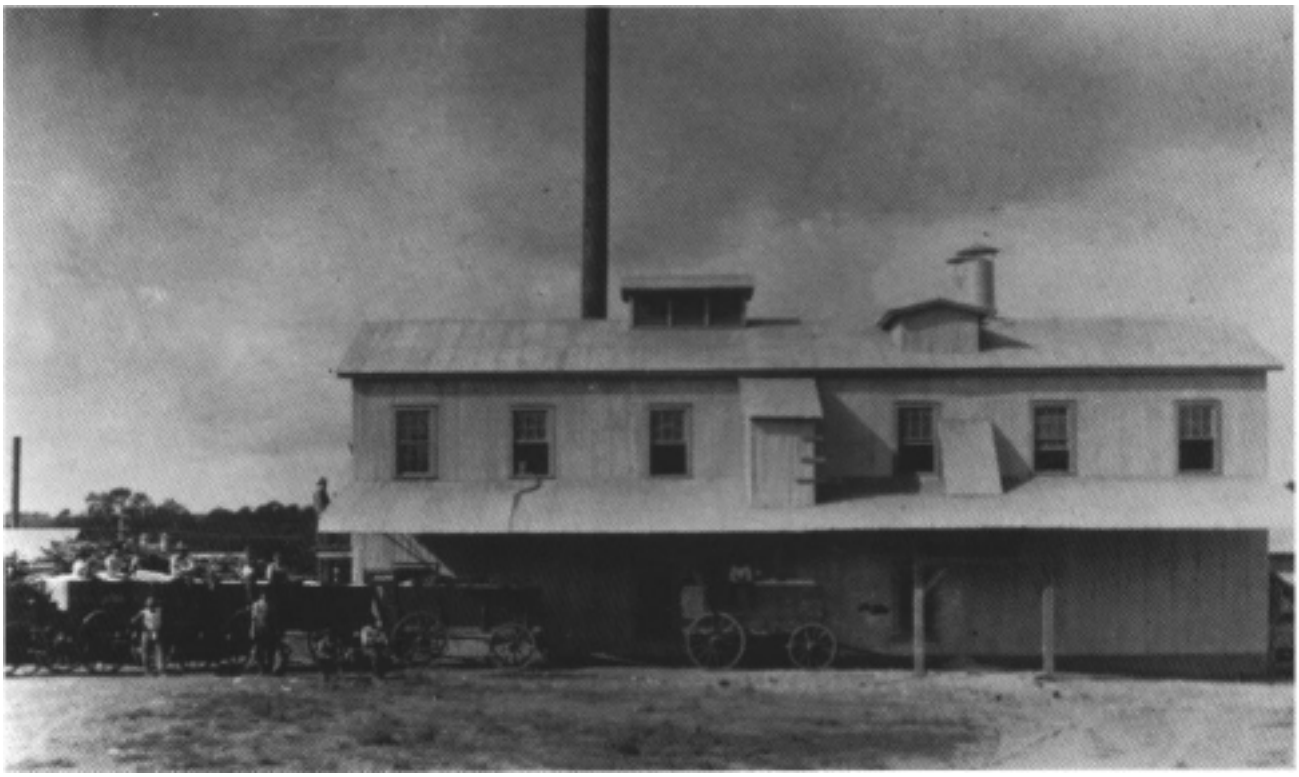
BURTON FARMERS GIN

Courtesy Doug Box, Doug Box Photography

A NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK

The American Society of Mechanical Engineers

Burton, Texas
April 15, 1994



Photograph of the Burton Farmers Gin as originally constructed. Notice the steam boiler smoke stack rising above a simple roof line. In 1925, a seed house was added to the front of the gin and the roof line altered to house seed elevators and stick removal equipment. An engine room with a business office above it was added to the left side of the building to house the Bessemer Type IV oil engine.

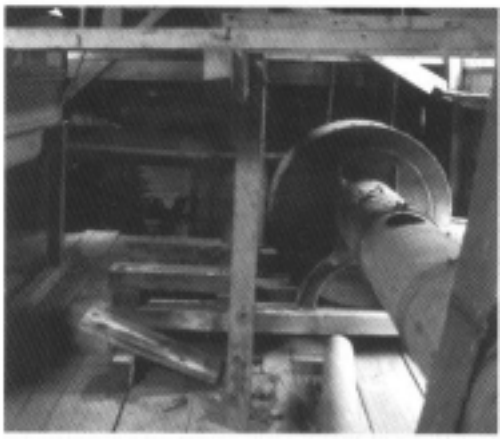
The significance of the Burton Farmers Gin is woven into the fabric of the industrial revolution. The extreme difficulty of ginning cotton, that is separating the fiber from the seeds, was a problem which had plagued mankind for four thousand years. Past civilizations from around the world had tediously hand separated the cotton seeds from the lint until the invention of the circular saw teeth gin design which was developed in the United States between 1789 and 1805. This "Cotton Engine" combined with the introduction of the first large textile mills in New England to start an inevitable chain of events that would fuel the industrial revolution.

The development of the American cotton ginning industry began with plantation-owned gins which were turned by hand or farm animals. The community gin, which served smaller, independent growers, was a result of the Civil War and the demise of the plantation. Steam engines were introduced to power the individual machines, like the gin stand and press, but manual labor was still required to move the cotton from one operation to the next. The development of the system cotton ginning plant by Robert Munger introduced the idea of pneumatically conveying the cotton from the wagon to the press while mechanical conveyors handled the seed and trash from the ginned cotton.

The Burton Farmers Gin represents the turn-of-the-century revolution of cotton ginning from a labor intensive operation to the system gin which was powered by a single engine. The economic importance of the community cotton gin was not just to provide cash to the local grower. River and rail transportation systems profited, ocean ports were developed, and cotton textile mills in New England and Europe were supplied. The industrial revolution flourished.

Robert S. Munger, inventor of system ginning.
Courtesy Continental Eagle Corporation

Suction pipe unloading seed cotton from a wagon.
Courtesy Doug Box, Doug Box Photography



Belt driven fan for Munger's pneumatic system of cotton ginning.
Courtesy Richard Hofmeister, Smithsonian Institution

ROBERT S. MUNGER *was born in July, 1854, in Fayette County, Texas. Between 1883 and 1892, Munger would devise the concept and technology of system ginning which is preserved in the Burton Farmers Gin and is still used by modern gins. Munger's father built a cotton gin in Mexia, Texas, and Robert S. Munger was raised in the family gin.*

Frustrated by the long line of wagons, impatient farmers, and an inability to fill available rail cars, Robert Munger completely redesigned the hundred-year-old tradition of the plantation style of ginning. His concept was to use fans to create a pneumatic system for conveying the seed cotton to the gin stand and the subsequent cotton lint from the gin stand to the bale press. Seed cotton was drawn out of wagons by 'telescope' suction pipes. The seed cotton was conveyed by air stream to a separator, mounted above the gin stands. A suction fan pulled seed cotton into the separator where the air would pass through a screen and the cotton would fall into a distributor above a group, or battery, of gin stands. The cotton was then distributed by means of the moving belt to feeders above each stand. The battery of gin stands was typically comprised of four or five units which could be operated together or separately. A common lint flue behind the gin stands provided a continuous flow of ginned cotton. The lint was then blown through this common flue to a single large condenser that replaced the small unit condensers formerly attached to each gin stand. The condenser contained a screen drum which separated the cotton lint from the air flow. Dust and fine particles were blown out through chimney stacks that passed through the roof. To handle the increased amount of cotton coming from the condenser, Munger invented the double-box press. Each box, attached to a wooden center post, was sized to contain one bale. The lint now flowed along a slanting chute or slide from the condenser to the press box. As one box was being filled with lint, the other was pressed, wrapped, tied, and rolled out onto the floor to be weighed, making baling as continuous as ginning.

Robert Munger's radical new system was so successful that he built a manufacturing plant in Dallas. The Munger Improved Cotton Machine Manufacturing Company was incorporated in 1887. Munger traveled to Birmingham and formed a partnership with W T. Northington and Daniel Pratt to create the Munger-Northington-Pratt Company to market ginning systems east of the Mississippi River. Supported by the foundation of the Daniel Pratt Gin Company, this new alliance would form the framework of the Continental Gin Company. Today, the Continental Eagle Corporation continues the legacy of the inventor and entrepreneur, Robert Munger.

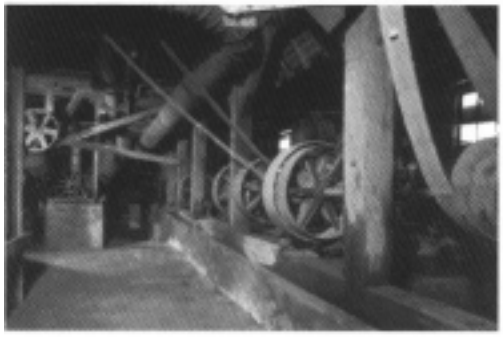
FRANKLIN H. LUMMUS *was born in 1824 in Massachusetts. Lummus and his father formed the New York Car and Steamboat Gas Company in 1857. After service in the Union Army, Lummus formed the New York Cotton Gin Company with partners Joseph Wilde and Henry C. Hogden. (Note that Mr. Hogden was descended from H. Ogden Holmes who had received caveats of invention for the cotton gin from the War Office in 1789.) In 1867, Franklin H. Lummus bought Israel Brown's share of a competing cotton gin manufacturer, W G. Clemens, Brown, and Company. In 1879,first one son, E. Frank Lummus, and in 1887, another son, Louis E. Lummus joined the company. F. H. Lummus Sons Company was formed in 1891. In April, 1896 four months after the death of Franklin H. Lummus, the family owned company became a corporation.*

Franklin H. Lummus. *From F.H. Lummus Sons Co. Catalogue,* 1909; courtesy Lummus Corporation

Lummus gin stand. Seed cotton is distributed by overhead conveyer and dropped into the feeder.
Courtesy Rihard Hofmeister, Smithsonian Institution

The F. H. Lummus Sons Company continued to grow, creating a board of directors, and acquiring land in Columbus, Georgia for additional facilities. In 1899, the company moved from Juniper, Georgia to Columbus, where a new manufacturing plant and ofice were built. By the turn of the century, Lummus was producing about six hundred gin stands per year. Lummus manufactured five types of gin stands, an elevator distributor, flues, a battery condenser, both simple screw and double box presses with steam trampers, and screw conveyors for seed handling.

Lummus was a pioneer in ginning research and was particularly attracted to the air blast method for doffing lint from the gin saws. In 1908 Lummus commissioned the Epps Air Blst Gin Company of Sherman, Texas, to manufacture and sell air blast doffing attacbments. In 1910, Lummus opened a branch office in Dallas and changed its name to Lummus Cotton Gin Company. As the air blast principal became accepted by ginners, Lummus issued licenses to Continental and to the Stephen D. Murray Company of Dallas to manufacture air blast attachments for their gin stands in 1916 Today, Lummus Corporation continues as a successful business which has stood the test of time.



Line shaft located on ground floor below the gin stands.
Courtesy Richard Hofmeister, Smithsonian Institution

Double box bale press allowed cotton to fill the box on the right while pressing and unloading a bale of cotton from the other box.
Courtesy Ricbard Hofmeister, Smithsonian Institution

Ground floor view of the double box press which rotates on a center bearing post with hydraulic press block and cylinder under the box on the left.
Courtesy Richard Hofmeister, Smithsonian Institution

THE BURTON FARMERS GIN is the oldest surviving example of the rural community system type cotton gin which used Robert Munger's concept of multiple stands and an integrated system of processing cotton from the wagon to a completed bale. It represents a mechanical age before the industrial use of electrical power and is the oldest extant example of the once widely used system gin which was mechanically powered by a single engine. This gin also incorporated a technological development resulting from the December 5, 1893 patent of the multi-jet, air-blast gin by Robert King. The Lummus Cotton Gin Company designed the Burton Farmers Gin. Built in 1914, it combined the skills of engineers, mechanics and carpenters to bring the machine design, plant layout, and wooden structure into industrial harmony.

The Burton Farmers Gin represents a significant modification in cotton-ginning technology adapted by the Lummus Cotton Gin Company from the work of Robert King and Robert Munger. Franklin H. Lummus had organized the Franklin H. Lummus Company in 1867 for the manufacturing of cotton gins. In 1910, Lummus opened a branch office in Dallas, Texas, and changed the company name to Lummus Cotton Gin Company that year. Lummus was particularly attracted to the air-blast principle for doffing lint from the gin saws. Lummus' engineers applied Robert Munger's concept of pneumatic conveying of cotton and the system gin.

This design used air to bring seed cotton from the wagon to a separator inside the building. The separator served to clean the cotton and separate the cotton from the air flow. Cotton dropped from the separator into a sealed, belt-distribution system that carried the cotton to feeders above a row of gin stands. Several gin stands were linked by flues to convey the ginned lint into a battery condenser above the bale press. Seed disposal was also automated, incorporating a system of wooden conduits, screw conveyors, and bucket elevators. Munger increased baling capacity by using a double box press, placed on a turntable to allow feeding and tramping of one box while hydraulically pressing and unloading the other box.

In the Burton Gin, the entire ginning system is mechanically driven by a single power source. The Bessemer diesel engine powers the ginning equipment through a line shaft, pulleys, and flat belting. This was a common arrangement for gins built during the first half of the twentieth century, but very few survived past 1970.

The Burton Farmers Gin also represents elements of the evolution of industry from steam power, to the diesel engine, and finally to electrical power in the last decade of the gin's commercial life. The original 1913 design was driven by a typical cotton gin boiler and steam engine. Cord wood for fueling the boiler was readily available as timber was cleared to make farm land. Little is left of the original steam engine except for the whistle above the engine room; the riveted steam accumulator vessels, which were converted for diesel exhaust mufflers; and the concrete-pillar supports for the steam engine. These concrete pillars now support timber bracing for the l25-horsepower, Allis-Chambers, 480 volt, 3-phase electric motor installed on the gin floor in 1963. The steam engine was replaced by a Bessemer Type IV, twin cylinder, oil engine in 1925. Machinery developed in the 1920's made the price of hand-picked cotton, with a minimum of trash, higher than the charge for mechanically-picked cotton with mechanical trash removal at the gin. The Burton Farmers Gin added the equipment needed to remove the trash from the seed cotton.

However, the steam boiler and engine were not powerful enough to turn the added equipment. The Bessemer diesel engine was installed in 1925 and powered the gin until the outboard crosshead failed during the 1963 ginning season. Cotton wagons quickly filled the town while the engine was hastily repaired. Beaumier Iron Works in nearby Brenham, Texas, provided a replacement crosshead. The Bessemer was repaired, and returned to service, but members of the Farmers Coop felt that it was no longer reliable as a power source. The Allis-Chambers electric motor was purchased and the Bessemer became a standby power source. The 1974 cotton crop marked the last year of commercial operation for the Burton Farmers Gin with a total of seven bales ginned by equipment capable of ginning seven bales per hour. Cattle had replaced King Cotton.

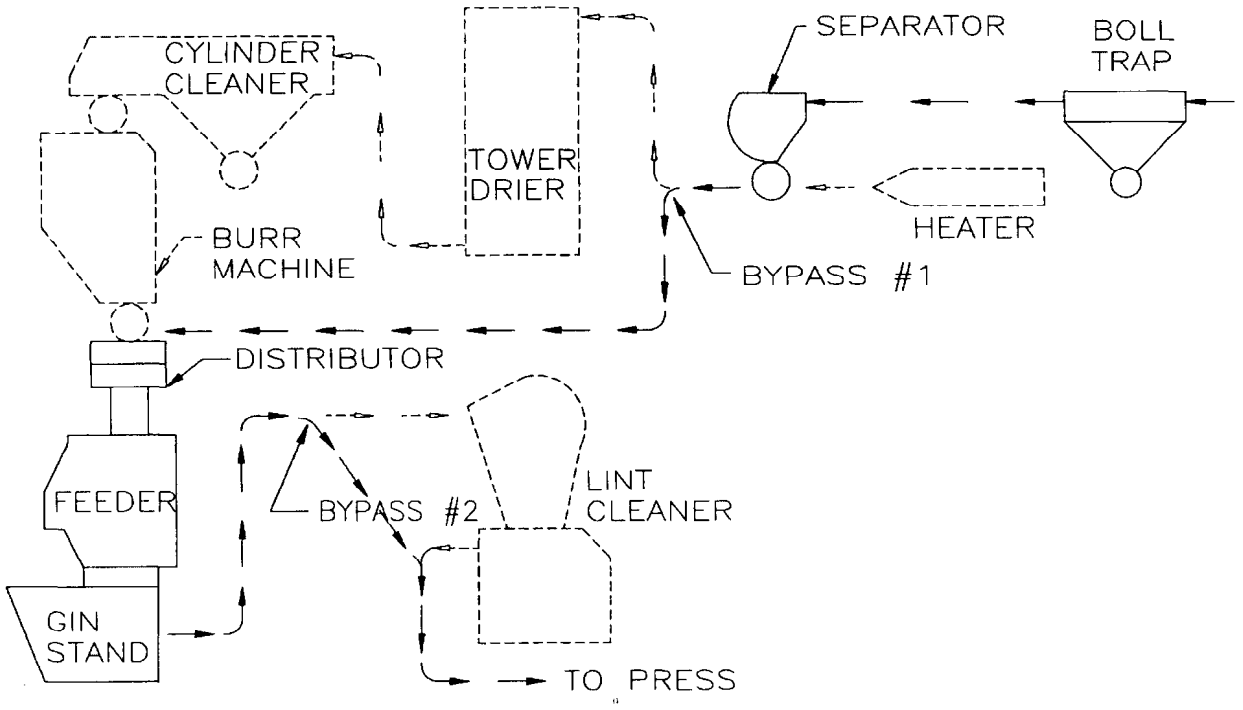
The Burton Farmers Gin is complete with not only the gin machinery, but also the paper records, dating from incorporation in 1913. These records chronicle the history of the gin as equipment was added. They also preserve a history of cotton production and sales in Washington County, Texas, over a period of sixty years.
Courtesy Richard Hofmeister, Smithsonian Institution

Courtesy Richard Hofmeister, Smithsonian Institution

Mechanical Specifications and Technical Data

The engine powers the gin through a main line shaft, 57 feet (17.37 m) in length and 2 15/16 inches (6.55 cm) in diameter. There are a total of 19 flat belt drives on the main line shaft and over 20 drives on secondary jack shafts. These drives use over 600 feet (182.88 m) of belting ranging from two to eight inches (5.08 to 20.32 cm) in width. A 40-inch (1.02 m) diameter suction unloading fan moves the cotton from the trailer to the 50-inch (1.27 m) diameter separator above the distributor. Cotton moves through a tower drier and Thermo Cleaner and into a horizontal cleaner located on the third floor of the gin. The tower drier and Thermo Cleaner can be bypassed if they are not needed. Cotton passes through the horizontal cleaner, into a two-saw stick machine and into an eight-foot (2.44 m) wide burr machine.

Both the horizontal cleaner and stick machine are 50 inches (1.27 m) wide. Cotton passes out of the burr machine and into the conveyor-distributor above the gin stands. There are five gin stands, each equipped with 80 saws for separation of the lint from the seeds. The ginned seeds are transported to an outside hopper by a conveyor under the gin stands, a bucket elevator into the seed scales, and a second screw conveyor. The ginned lint is doffed from the saws by an air blast fan which also conveys the lint to the lint cleaner.



Process Flow Diagram

Another fan conveys the lint from the lint cleaner to the condenser above the press. The press is a Lummus flat bale press with wooden doors and steel sills and side beams.

In order to facilitate operations and restore the gin to 1930's configuration, the horizontal cleaners, stick machine and burr machine have been bypassed. As previously noted, the Moss lint cleaner, installed in 1954 has also been bypassed.

The cotton gin is powered by a horizontal two cylinder 14" (35.56 cm) bore x 18" (45.72 cm) stroke Bessemer Type IV Oil Engine rated for 125 hp (92.5 kW) at 250 rpm. The shipping weight of the engine with clutch and standard equipment is 31,738 pounds (14,426.4 kg). The oil engine is of the two stroke diesel design with water injection provided to each of the respective intake ports. The oil engine is designed to fire various fuel oil grades with adjustable water injection to provide proper combustion. The 323 lb. (146.8 kg) pistons stroke at 180 degree intervals. Each piston drives a horizontal rod which threads into a sliding crosshead assembly containing a wrist pin for the connecting rod to the crankshaft which drives two 78" (1.98 m) diameter 3,285 lb. (1493.2 kg) flywheels. A flywheel governor acts to center the eccentric drive to the fuel injection pump plunger which speed regulates the engine at 250 rpm. A shoe type clutch with manual lever engagement is fitted to the drive shaft on the other flywheel.

Burton Farmers Gin before restoration 1986.
Photo by Rick Lewis, Texas Historical Commission.

THE RESTORATION PROJECT

The Cotton Gin lay dormant from 1974 to 1986, when a group of local citizens formed an organization to save the property from being sold. The nonprofit organization incorporated under the name Operation Restoration, Inc. and acquired the gin with a loan from one of the members. After several years of research and planning, restoration began in late 1990.

The restoration has progressed in several phases. The initial phase involved a thorough cataloging of all resources. This included an extensive photographic recording process by the Smithsonian Institution. All gin records were indexed and stored in acid free boxes. During this time, Operation Restoration was formed and plans were made for the museum and interpretive center.

The next major restoration project was the Bessemer engine. The project was basically an overhaul of the engine and a rebuilding of the fuel injection system. A $5,000 grant from Cooper Industries provided the funding for most of the expenses for repairs to the engine. Parts, materials, and services were donated by many companies and machine shops from throughout the state of Texas. The engine was started for the first time on February 29, 1992, and has been operated for approximately 100 hours since the overhaul.

Once the engine was operating, the next phase of restoration was to rehabilitate the gin machinery. The four fans were removed and repaired. All flat belting was inspected and, with few exceptions, was replaced with "new" belting. The belting was donated from a number of sources that no longer had use for it. The restored fans were re-installed.

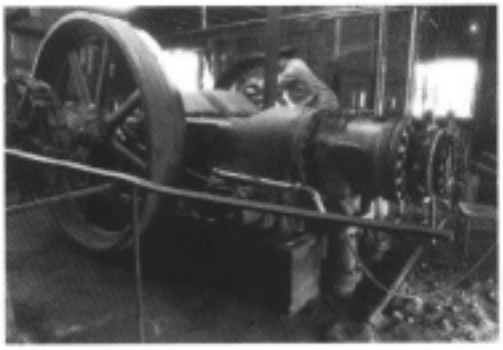
The saws in the gin stands and feeders were inspected and found to be in excellent shape. The hydraulic pump for the bale press was manufactured by Beaumier Iron Works in nearby Brenham, Texas. This company is still in operation, although they no longer operate a foundry or build press pumps. The existing pump was extremely worn and in need of extensive repairs. Beaumier Iron Works was generous enough to provide the parts to build another pump and the original pump is being used for a static display. In order to restore the gin to its 1930's condition, the Moss lint cleaner was by-passed and the cotton was routed from the gin stands directly into the press. The gin stands needed several days of cleaning and oiling, but were otherwise in excellent condition.

The final phase of restoration involved the building itself. Overall, the building was in good condition although it did show the effect of 20 years without maintenance. The roof had a few leaks and some of the wood was beginning to show signs of decay. In the spring of 1993 the roof was repaired and decayed wood was replaced. After the roof was repaired, the entire building was painted with an industrial coating. Additionally, a set of rear stairs were installed to facilitate tours moving through the building. The location and design of these stairs and the painting of the building was coordinated with, and approved by, the Texas Historical Commission.

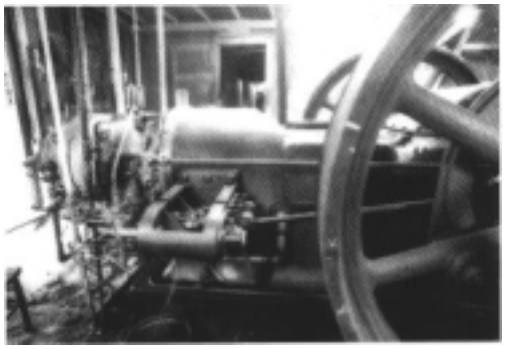
The Burton Farmers Gin survives in its original building and it is operating with the machinery that was in the gin when it closed down. It is open for guided tours, and the Bessemer diesel engine is in operation during the third weekend of April for the annual Burton Cotton Gin Festival.

The Bessemer Type IV oil engine is, by itself, an historic piece of equipment. It is the largest operating internal combustion engine of this vintage in the southern United States, and possibly, the entire country. There are certainly few, if any, engines of this age and horsepower in operation outside of a museum. Its restoration is a story of an old engine and interested young people. The oldest of the people who helped to restore "The Lady B", as it is called, were young people in 1925. "The Lady B" had been idle for twenty years when the overhaul work began in January of 1991.

Battery of five Lumus 80-saw gin stands.
Courtesy Richard Hofmeister, Smithsonian Institution



Bessemer engine drives the line shaft through a clutch on the right with the clutch handle shown in the foreground.
Courtesy Doug Box, Doug Box Photography



125 hp Bessemer Type IV oil engine installed in 1925.
Courtesy Doug Box, Doug Box Photography

The heads and hot plug ends were off. The pistons were corroded and seized to the pitted cylinder walls. The cast iron cylinder cooling water jackets were cracked. The forced feed oil lubricator and geared fuel pump were gone. The fuel injector pump and injectors were a corroded basket case. The cooling tower and water tank were rotten and useless. The twin, eight-inch-diameter (20.32 cm) exhaust pipes had been dug up and cut into road culverts. One piston-to-connecting-rod crosshead was broken. The fuel-oil, water and air-start piping had been removed. The Model T engine for powering the starting air compressor and the starting air receiver were gone. Also, the men with the memories of how this puzzle fit together had been lost to time.

Cooper Energy Aftermarket Services, Mount Vernon, Ohio, provided an original printing of the engine parts list, and the original drawings of the parts had survived on microfilm. Many companies donated components and services, such as the cooling water tank, a pressure vessel for the air start system, repair of the engine crosshead, 200 ft. (59.96 m) of 8-inch (20.32 cm) diameter exhaust pipe, and a ratchet-drive lubricating oil pump. A group of dedicated volunteers worked on Saturdays for fourteen months until the Bessemer diesel engine started on February 29, 1992.

Bessemer engine nameplate.
Courtesy Greg Felder

Bales of cotton with a model of Eli Whitney's hand cranked "Cotton Engine."
Courtesy Doug Box, Doug Box Photography

THE HISTORY AND HERITAGE PROGRAM OF ASME

The ASME History and Heritage Recognition Program began in September 1971. To implement and achieve its goals, ASME formed a History and Heritage Committee, composed of mechanical engineers, historians of technology, and the Curator Emeritus of Mechanical and Civil Engineering at the Smithsonian Institution. The Committee provides a public service by examining, noting, recording, and acknowledging mechanical engineering achievements of particular significance. The History and Heritage Committee is part of the ASME Council on Public Affairs and Board on Public Information. For further information, please contact Public Information, the American Society of Mechanical Engineers, 345 East 47 Street, New York, NY 10017-2392, 212-705-7740; telefax 212-705-7141.

The Burton Farmers Gin is the 109th National Historic Mechanical Engineering Landmark to be designated. Since the ASME History and Heritage Program began, 163 Historic Mechanical Engineering Landmarks, 6 Mechanical Engineering Heritage Sites, and 6 Mechanical Engineering Heritage Collections have been recognized. Each reflects it influence on society, either in its immediate locale, nationwide, or throughout the world.

An ASME landmark represents a progressive step in the evolution of mechanical engineering. Site designations note an event or development of clear historical importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The ASME Historic Mechanical Engineering Recognition Program illuminates our technological heritage and serves to encourage the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers, and helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

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