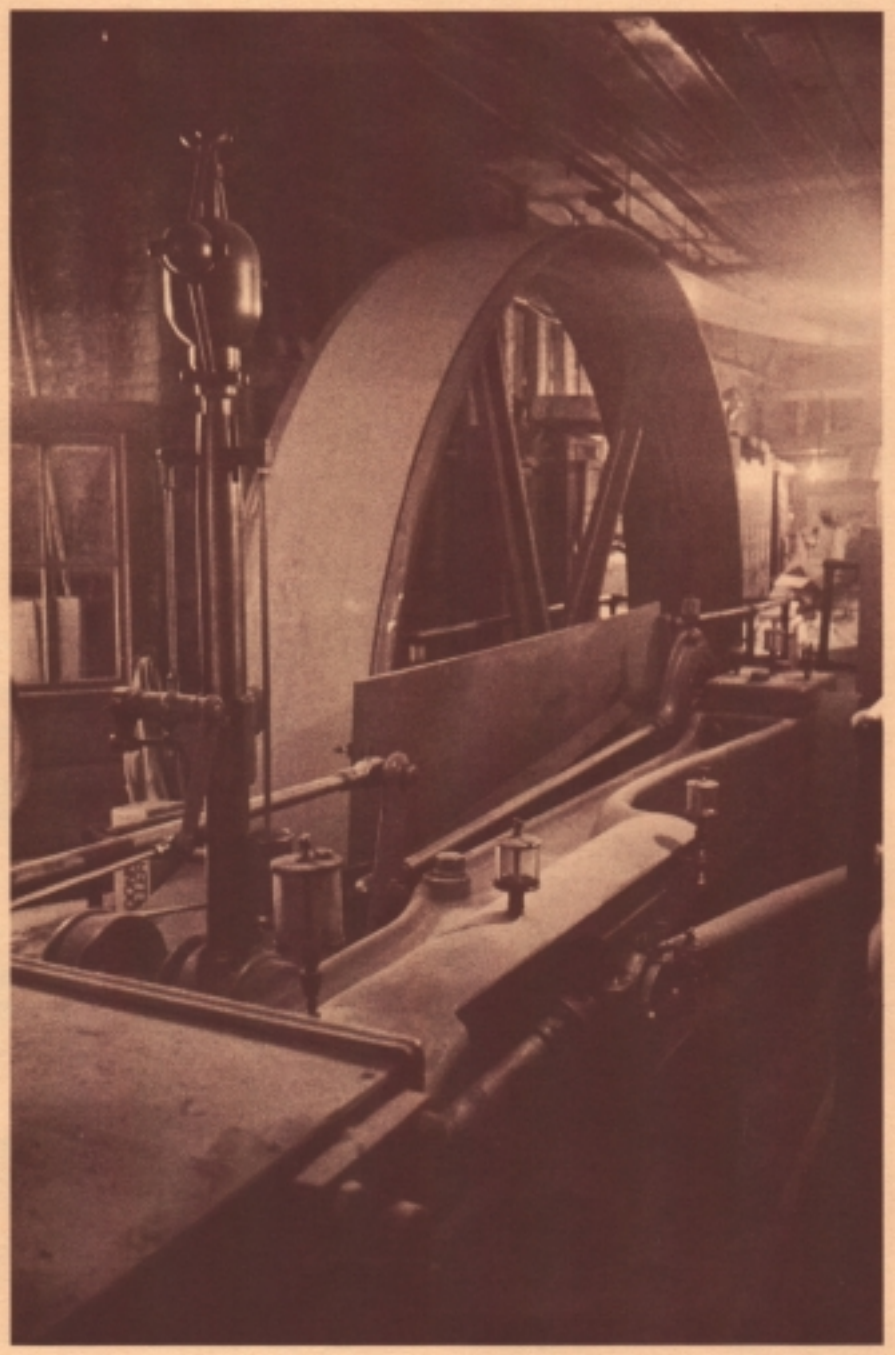
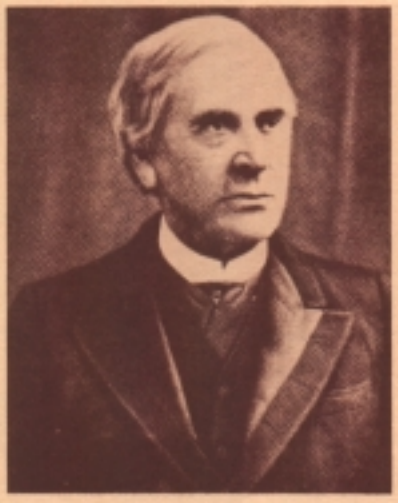
Regional Historic
Mechanical Engineering
Landmark

The American Society of
Mechanical Engineers

Harris-Corliss Steam Engine
Randall Brothers, Inc.
Atlanta, Georgia
October 16, 1985





Wm. A. Harris

Sometime during 1977 the old 350 horsepower Harris-Corliss engine at the Randall Brothers Co. was retired from its job as a prime mover for the woodworking plant. Retirement did not come because of the age of the engine, over 80 years, but because of the U.S. Environmental Protection Agency's concern over the smoke from the boiler smokestacks. The engine was still, and is to this day, in perfect working order.

Because of the EPA concern, the boilers, which had previously been fired by scrap woodchips from the woodworking plant, were converted to oil, but even this did not prove successful. Fuel oil was too expensive and winter supplies are unreliable. In 1977 the Randall Brothers plant switched to grid-supplied electricity

One of the final jobs for the engine was to run a vacuum system that sucked up sawdust around the old plant, but that job, too, yielded to outside electricity.

History of the Randall Brothers' Engine

The Randall Brothers' engine has been around so long that no one remembers when things happened to the engine or even when it was purchased. According to a brass plaque on the engine, it was built by the William A. Harris Steam Engine Co. of Providence, R.I. Historical records suggest that it was built sometime before 1895, because the engine was exhibited at the Cotton States and International Exposition of 1895 which took place on the site of what is now Piedmont Park in Atlanta. The engine is typical of the machinery that helped Georgia recover from the effects of the Civil War.

Records from the William A. Harris Steam Engine Co. indicate that Exposition Cotton Mills, Atlanta, Ga., ordered a 350 horsepower engine on April 12, 1898 for delivery on May 16, 1898. This order was filled with the engine that was on exhibit at the 1895 Exposition.

Harris Steam Engine Company works–1878

Randall Brothers, Inc. purchased the engine from Exposition Cotton Mills sometime between 1898 and 1910. The engine was used on a regular basis to drive an electric generator and to power machinery, including lumber saws, through overhead line shafting. The boilers that supplied the steam were capable of burning wood, coal or gas until converted to fuel oil in the 1970s.

This Harris-Corliss steam engine served the Randall Brothers for more than 75 years. Toward the end of its operation there were some problems finding replacements when parts wore out. When parts needed to be replaced, Randall Brothers simply made them in their own machine shop.

Although no longer in regular use, the steam engine is in its original location at the Randall Brothers plant. It is in outstanding mechanical operating condition, and is regularly available to the public, particularly engineering classes at the Georgia Institute of Technology for whom the boilers are occasionally fired up to show the operation of a classic Corliss steam engine.

The Corliss Engine

Corliss type engines were well made and efficient, but expensive. The best quality, hard, close-grain charcoal iron was used for the cylinders and other castings. The cylinders were generally steam-jacketed and provided with patented safety relief attachments for the escape of entrained water.

The essential feature of the Corliss engine is the valves that admit the steam to and exhaust it from the cylinder. There are separate steam and exhaust valves for each end of the cylinder.

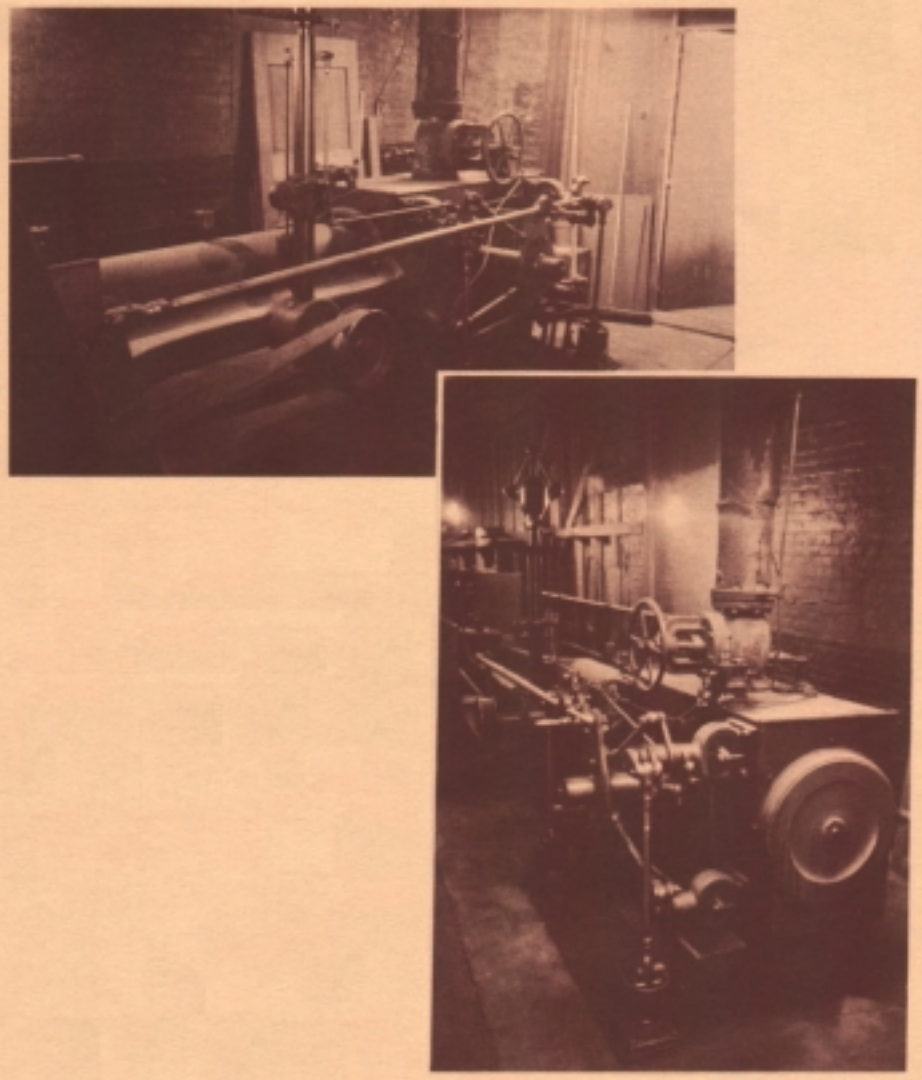
The valves are cylinders that oscillate about their longitudinal axes in cylindrical spaces bored out of the cylinder casting.

The oscillatory motion alternately exposes and covers openings (ports) connecting to the cylinder. The motion of the valve is provided and controlled by a wrist plate drive mounted on the side of the cylinder.

It should be noted that only the exhaust valves are directly connected to the wrist plate so that they are positively controlled by the plate's motion. The inlet valve is not positively connected to the wrist plate, but is arranged to be moved so far, at the beginning of the piston stroke at which point a disengaging or "trip" gear acts and the valve is closed very rapidly under the action of a spring.

The actual speed of closing is controlled by an air dash-pot with a valve that can be adjusted to give the desired speed of valve motion. The trip gear can be made very "light" so that the governor is not affected by its action, consequently the latter can be made sufficiently sensitive to keep speed variations within very narrow limits (one percent of nominal).

The valves are small and the area of contact very limited, so friction is re-



Two views of Harris-Corliss Engine as it appears today, still at Randall Brothers almost 90 years after it was purchased.

duced to a minimum. Other advantages of this gear compared to more conventional piston and slide valve gears are that:

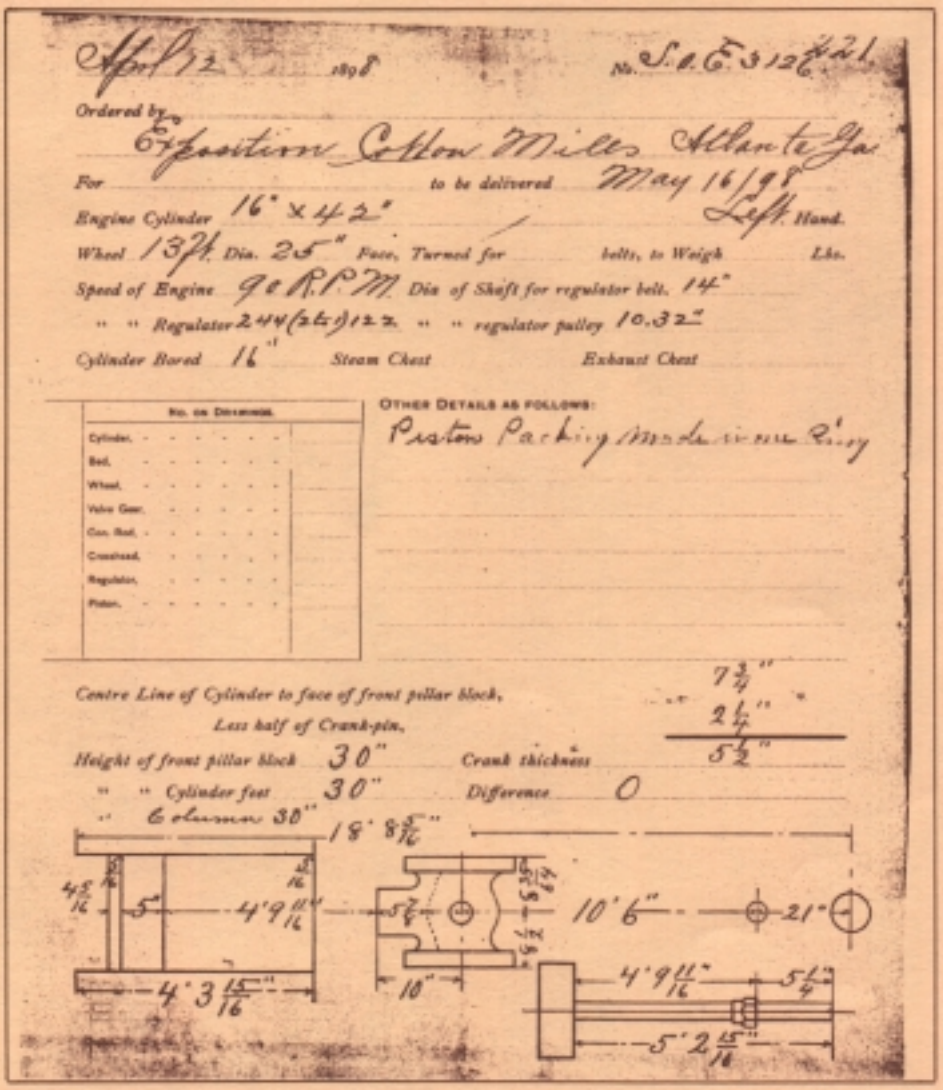
1. it is light;
2. it is easy to maintain in a steam tight condition because they can be made self-adjusting within the valve gear;
3. the steam enters and leaves the cylinders by separate ports so the effects of heating and cooling of the cylinder material on the steam are reduced;
4. the clearance volume at the ends of the cylinder can be made very small because the valves can be located at the very end of the cylinder;
5. valve action is very rapid thus reducing "wiredrawing" effects at the inlet valve.

The Corliss valve gear led to extreme efficiency in terms of steam consumption. This general type of valve gear was the most efficient for controlling low to medium speed engines (20 to 175 rpm).

Randall Brothers Engine

The Randall Brothers' Harris-Corliss engine is rated at 350 horsepower at a speed of 90 rpm. The flywheel is 13 feet in diameter with a 25-inch face and the drive belt is approximately 102 feet long. The engine cylinder measures 16 inches in diameter with a 42-inch stroke. The crank shaft diameter is 14 inches. This simple engine operates at a steam pressure of 125 psi.

The American stationary steam engine business was an outgrowth of the New England textile industry which began with the Slater Mill in Rhode Island just before 1800. The result was that at one time Providence, R.I., was the world center of steam engine manufacturing.



Order for Harris-Corliss Engine, April 12, 1898

George Henry Corliss (1817-1888)

George H. Corliss was an inventor and manufacturer of the finest and most efficient steam engines of the late 19th century. He was born in Easton, N.Y., June 2, 1817, and began his working life as a clerk in the factory store of William Mowry & Co., a cotton manufacturer.

In 1838 he opened his own store, which led him to consider, as a result of complaints by his customers, the possibility of using machinery in the manufacture of ready made boots and shoes. This gradually led him into the invention and construction of various types of machinery and eventually he found his way into the steam-engine business.

In 1844 he moved to Providence, and joined the machine and engine business of Fairbanks, Bancroft & Co. By 1846 he was a partner in the firm and had invented the steam engine that bears his name. This steam engine, including an improved valve gear, was patented in 1849. The patent was reissued in 1851 and again in 1859. This special valve gear revolutionized steam engine design.

In 1856 George H. Corliss incorporated the Corliss Steam Engine Company in Providence. In time the company became the world's largest maker of stationary engines. During the Civil War, the Corliss Company manufactured a number of precision parts for the iron-clad *Monitor*.

Corliss held 68 patents and pioneered ideas in standardization and mass production. He died in 1888.

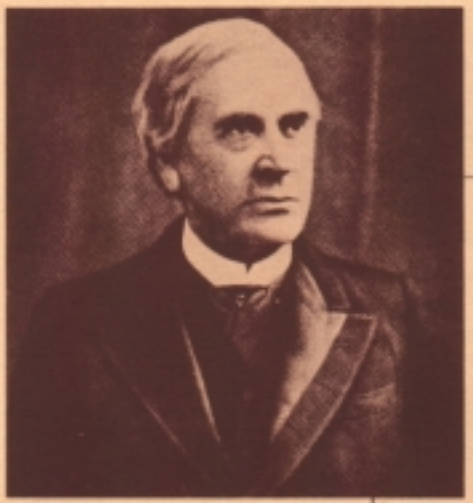
William Andrew Harris (1835-1896)

William Andrew Harris began his career as a bank clerk at the Union Bank in Providence in 1852. He left the banking business in 1855 to take a job as a draftsman at the Providence Forge & Nut Company (Rhode Island Tool Company).

In 1856 he became a draftsman for the Corliss Steam Engine Company. For eight years he was the right-hand man of George H. Corliss and, during that time, made all the drawings for that inventor's numerous patent applications.

He was the first of Corliss' chief assistants to leave the Corliss Company. In 1864, he established the William A. Harris Steam Engine Company—also in Providence—to manufacture the Harris-Corliss steam engine. Harris paid royalties to Corliss until expiration of the basic Corliss patent.

The company built more than 5,000 engines and sold them all over the world. They were particularly popular in textile mills, but many went to Cuba to drive sugar mills; others were used in early electric lighting plants and still others were used in the Connecticut brass industry and in mines in the West.



George Henry Corliss

William A. Harris

ACKNOWLEDGEMENTS

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Georgia State Department of Archives and History
Atlanta, Georgia

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Providence, Rhode Island

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Providence, Rhode Island

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Rhode Island Historical Society
Providence, Rhode Island

The New England Museum of Wireless and Steam, Inc.
East Greenwich, Rhode Island

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The American Society of Mechanical Engineers
345 East 47th Street
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