



James and Henry Leonard both worked at the Saugus Iron Works in the 1640's after arriving in America. They were specifically recruited for their skills in iron refining. It appears that James and perhaps Henry first worked at the Braintree site about 1645, that being owned also by the Winthrop group and the first to "fire up," but for a variety of reasons was not a successful operation. The Saugus blast furnace followed in 1646 and operated until the 1670's, when it was abandoned. Archeological work on the site in the 1950's uncovered its remains and allowed for its reconstruction.

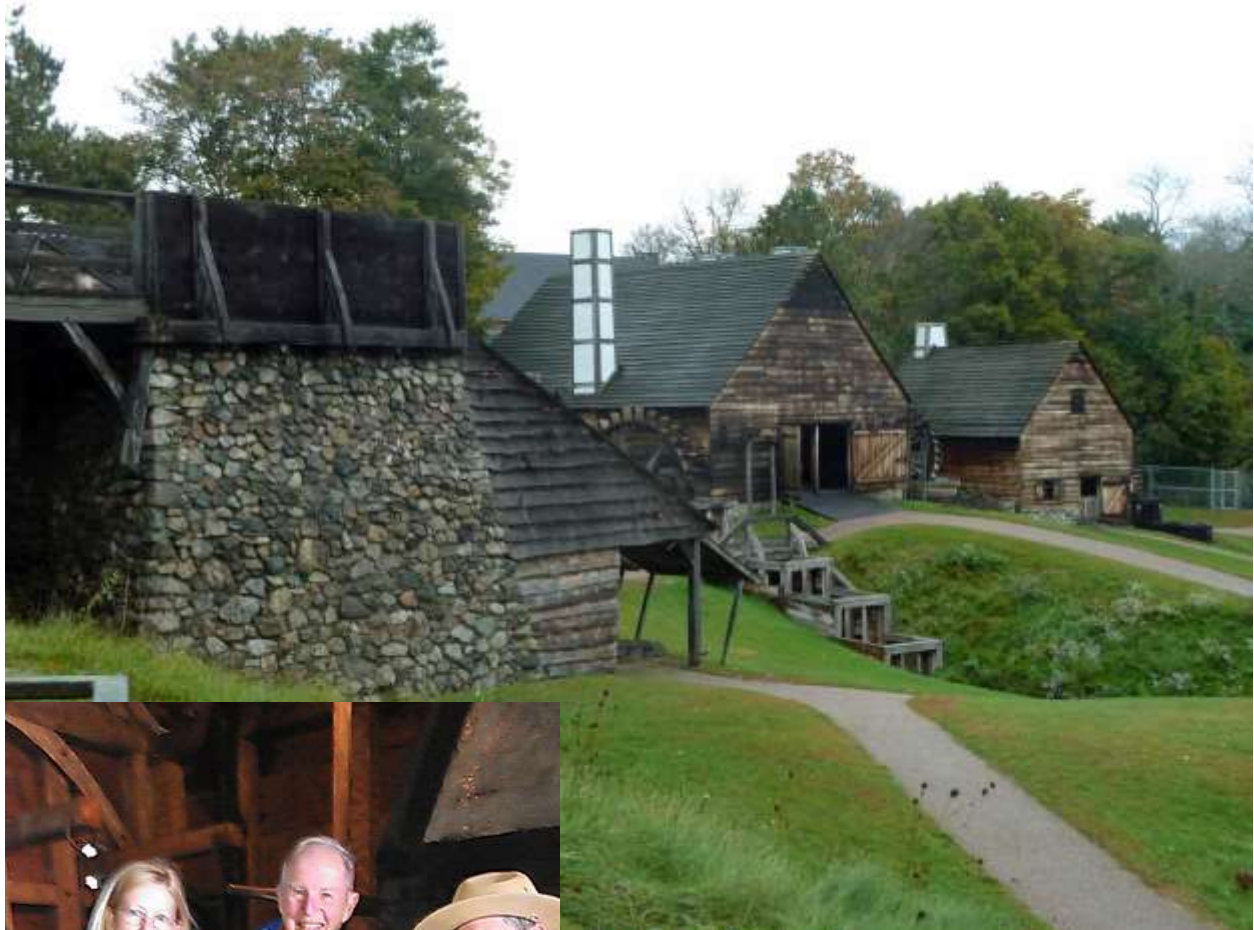
To the right is a model of the reconstructed replica of the Saugus Iron Works as it existed when James and Henry worked there. It was one of the 12 largest such refineries in the world in the 1640's.



The blast furnace is the first building on the left. This is where the ore, mixed with gabbro as a fluxing agent and charcoal as the fuel, was refined from the ore and cast into "pigs." In some cases, the iron went directly into castings of pots, kettles, skillets, firebacks, and salt-pans.

In the second building, in the middle of the picture, the cast iron "pigs" were beaten by a 500-pound hammer into rods of "merchant bars," which were sold to blacksmiths for the manufacture of finished products. The third building housed the rolling and slitting mill, where the bars were flattened into strips more easily turned into saw blades, nails, horse shoes, wagon wheel tires, and such. Water was used for power, and transportation of the finished product went by boat from the Saugus harbor.

Thank you to the National Park Service for their excellent descriptions and teaching materials!



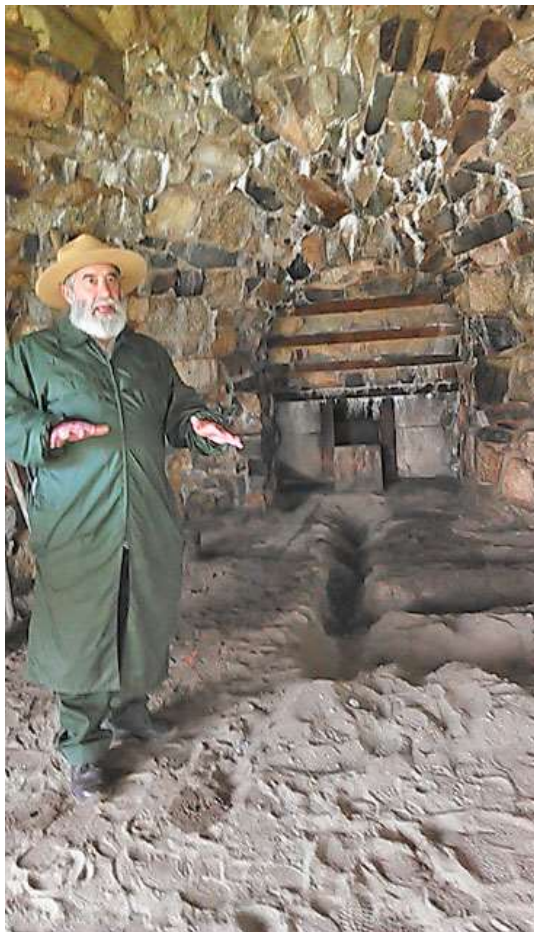
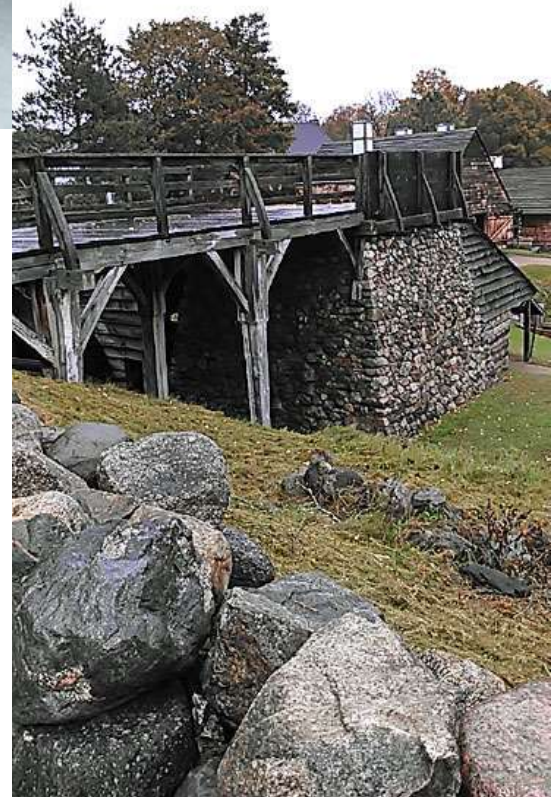
Constructing an iron refining operation in the 1600's was no easy task. There were no architects or engineers to help with the design. There were no power tools to help with the construction. Metal was in short supply, which helped make the construction of these small (by current standards) iron works economically desirable. There was no electricity and no power sources other than water, horses, and people. Most of the workers, including the master iron workers, were illiterate and couldn't keep records. This meant that a clerk to keep track of orders of charcoal, iron ore, etc., and to make sure stock holders and suppliers were paid was an essential employee. Ironmasters were relatively well paid, earning up to ten times the wage of an unskilled laborer and often given a house to live in. Masons and carpenters were also important employees of an iron works. An iron works could employ hundreds of people, including the suppliers of charcoal and iron ore.

Picture on left: Two descendants of James Leonard, Sue Leonard and Brad Leonard, and a Park Service Ranger at the Saugus Iron Works National Historic Site.



One of the innovations of the Belgian/French method of iron refining was the use of a giant bellows to pump more air into the burning charcoal in the blast furnace, heating the temperature to 1400 degrees. Cogs would lift the top of the bellows, filling it with air, and then let it drop, pushing the air into the furnace.

The blast furnace was loaded from the top with charcoal, gabbro, and iron ore. Once a blast was started, it continued 24 hours a day, 7 days a week, for 20 to 40 weeks, meaning fuel, fluxing agent, and ore had to be gotten and stored in advance of the blast.



The molten iron came out at the bottom of the blast furnace and was poured into molds in the sand called pigs (hence pig iron). The molds had to cool and harden before they could be moved to the next building and next stage of refinement. Pig iron is brittle, which limits its utility in some usages, such as nails or wagon tires or horse shoes.

The National Park Service ranger doing the interpreting of the site is a descendant of an ancestor who joined with some of the sons of Henry in their hi-jinx that got them in trouble with the Massachusetts Bay Colony authorities, so he was knowledgeable about the genealogical as well as the historical stories relating to the foundry.



The second step in the process involved hammering the impurities out of the pig iron to make it into wrought iron. Wrought iron is less brittle than pig iron and has more uses. This process involved a 500 lb. hammer raised by the action of a water wheel in the sluice raising the hammer through the use of cogs and then dropping it against an anvil.



The third step in the process was to put the iron in a form more useful to blacksmiths and other manufacturers in their making of finished products, like axes, horse shoes, and nails. This was done in the slitting and rolling mill illustrated on the left. The bar iron was heated, rolled, and split into thinner flats or wires that could then be cut and made into wheel tires or nails.