IRON IN AMERICA

by John H. Lienhard

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Today, we smelt the first American iron. The University of Houston's College of Engineering presents this series about the machines that make our civilization run, and the people whose ingenuity created them.

Iron is such a primal need for any modern civilization. One of the first things that early colonists went after, as they tried to recreate Europe in the American wilderness, was iron. Iron ore had turned up on an island off the North Carolina coast in 1585. That was too inaccessible to mine, but then Jamestown settlers found iron ore on the mainland.

In 1608, just after the Jamestown colonists came, John Smith shipped several barrels of ore back to England. The East India Company found that the ore yielded top-quality iron. So in 1619 they set out to buy Virginia iron. And a Virginia company sent iron-workers out to set up smelting operations. Three years later, just as a settlement of 25 people was starting to smelt iron near present-day Richmond, Virginia, Indians massacred them and destroyed their furnaces. Virginia Iron-making limped after that, and eyes turned to the Plymouth Colony in Massachusetts.

In 1644, only 24 years after the Pilgrims landed, John Winthrop set out to build bog-iron smelters on two sites -- one in Braintree, south of Boston, the other just north of Boston on the Saugus River. The Saugus Iron Works operated until 1668, when a labor shortage put it out of business.

The Saugus Works was an integrated facility. It had a dam to provide water power for forging, a smelting furnace, a trip-hammer forge, and a rolling/slitting mill. The name given to the factory was *Hammersmith*, and it produced two kinds of iron. *Cast iron* was poured directly into molds to produce an end product. The other form was cast into "pigs" -- large lumps that could either be remelted and cast later or made into *wrought* iron.

To make wrought iron you melt the pig at a high temperature to reduce its carbon content. Then you forge it to refine its grain structure. The result is both tough and strong.

Now, what do you suppose the primary product of the Saugus Works was? What do people need when they're trying to build cities from scratch? They need lots of *nails*. The Saugus smiths milled most of their wrought iron into thin strips. Then they slit those strips into small square rods and sold them to householders.

It was up to the user to cut the square rods into short lengths and use small dies to shape points and heads. That kind of nail production was rare in Europe, but our needs weren't European needs. New wooden buildings were our first order of business in the 17th

century. So the Saugus Iron Works was not just a well-put-together factory, it was a visionary response to basic need.

Today you can visit the rebuilt Saugus works just off Highway One. The blast-furnace is working again. The water wheel drives the hammer forge and rolling mill. And, while you're wondering how they set such complex equipment up so quickly, a tour guide will hammer out a square nail for you, right there where it all began.

I'm John Lienhard, at the University of Houston, where we're interested in the way inventive minds work.

(Theme music)

Hartley, E. N., *Ironworks on the Saugus: The Lynn and Graintree Ventures of Undertakers of the Ironworks in New England*. Norman OK: University of Oklahoma Press, 1957.

To see the rebuilt Saugus (Hammersmith) Ironworks, click on the website: http://www.nps.gov/sair/

Archaeologist James Brothers IV, a student of Virginia iron, writes (in 2004) to indicate that since this episode was written (ca. 1996) much has been learned. He recommends reading Robert Gordon: *American Iron: 1609-1900.* Baltimore, MD: Johns Hopkins Univ. Press, 2001 reprint. Brothers also points out that the Saugus reconstruction was based heavily upon the illustrations in Diderot. Hence the reconstruction may well represent eighteenth-century French practice better than it replicates seventeenth-century British/colonial iron works.

This is a greatly reworked and emended version of Episode 22.