Society for Industrial Archeology · New England Chapters

Volume #42 Number 2 2021

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Contributors

Rick Ashton, Gil Cooke, David Dunning, Gerry DeMuro, Robert Timmerman, Sara Wermiel

Northern Chapter Officers

David Dunning, President
Dianne Chase, First Vice President
David Coughlin, Second Vice President
Richard Coughlin, Treasurer

Southern Chapter Officers

Leonard Henkin, Secretary
Sara E. Wermiel, Treasurer

Committee of the whole management committee:

Betsey Dyer, Leonard Henkin,
Ron Klodenski, Robert Timmerman, and
Sara Wermiel

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NNEC-SIA President's Report

NNEC-SIA Annual Meeting

The fall meeting was held at The Common Man restaurant in Plymouth, NH on October 16th during the fall tour lunch. It was voted to eliminate future tour flier mailings; see separate article. New members were accepted and welcomed: Richard Strauss, and David, Many Ann and Dianne Chase. Dianne offered to become our new First Vice President. Other than Dianne, no new officers were elected as no-one else offered to serve.

NNEC-SIA Treasurer's Report

Bank Balance on September 30, 2021: $4,351
Bank Balance on September 30, 2020: $4,296
Thus, the bank balance has increased $55 in the past year!

2021 Annual Paid Membership on Sept 15, 2021: 23
Life Members: Estimated at 30.
Annual Paid Membership was down about 18% from last year. This is likely due to the cancellation of the 2021 Plymouth Conference and the 2021 Spring Tour.
Submitted on October 26, 2021 by:
Rick Coughlin, Treasurer, NNEC-SIA

William Seabury Reid. 1934-2021

William Reid, a life member and supporter of SNEC-SIA, passed away in April. According to his wife Ala, he was "fascinated by industrial archeology," and together they travelled the world, "riding historic trains, seeing interesting locks and bridges, and exploring unique industrial buildings."

Report on SNEC Annual Meeting

Sara Wermiel, SNEC Treasurer

SNEC's annual meeting was held via Zoom on Nov. 17, 2021. Tim Richards presented a talk, "Re-Discovering an 18th-19th Century Tide Mill on Cape Cod," about the history of a grist mill in Truro, Mass., powered by tidal ebb flows.

At the business portion of the meeting, members agreed to a proposal by Sara Wermiel to re-elect the two currently serving officers: Wermiel, treasurer, and Leonard Henkin, secretary. In addition, members agree the Committee of the Whole, which helps with chapter activities and other matters, should continue its work.

Regarding dues: members agreed to a proposal by Sara Wermiel that for SNEC members in good standing (i.e., paid dues in 2021 or are life members), membership for 2022 will be complementary, meaning, they need not pay dues. We appreciate members supporting SNEC through the constrained COVID days. For former members who did not renew in 2021, dues for 2022 will be the usual amount: $10 before March 1, $15 thereafter. For students and new members, dues are $8, anytime.

David R. Starbuck, 1949–2020

James L. Garvin

As most of you know by now, the previous newsletter Editor, David Starbuck, passed away on December 27, 2020. Here is David's official obituary.

David R. Starbuck, one of the country's most prolific practitioners and writers on historical archeology, died on Dec. 27, 2020 of cancer, having worked to the very end of a life filled with purpose and accomplishment. His final dig at Fort Edward in New York ended in the month before his death at age 71. David graduated from the University of Rochester and earned his master's and doctorate degrees from Yale. For 28 years, he served as professor of anthropology at Plymouth State University in New Hampshire, having held earlier faculty positions at Rensselaer Polytechnic Institute, Boston University, and Yale.

David was devoted to classroom teaching, but even more so to archeological fieldwork, conducting some 70 field schools during his career. He was a pioneer in industrial archeology in the U.S., entering the field in 1976 when he began to excavate the long-hidden remains of one of the earliest glass factories in New England, the Temple Glassworks (1780–82) in N.H., under the auspices of Boston University.

David followed this work in the late 1970s and 1980s by directing a series of interdisciplinary field studies at Canterbury (N.H.) Shaker Village, combining documentary research, excavations, cartography, and photography. That site, then occupied by some of the last Shakers and now a National Historic Landmark, was making the transition from a religious community to a museum. David's baseline documentation was essential to the preservation of the village's physical integrity and the training of its staff and trustees as it passed from the hands of the Shakers. Under the sponsorship of Boston University and the University of New Hampshire, and with financial aid from the N.H. State Historic Preservation Office, Starbuck marshaled the efforts of a score of historians, architectural historians, surveyors, and archeologists to produce reports on more than twenty individual subjects. David continued his Shaker IA work in 1983 when he mapped the waterpower system at Hancock (Mass.) Shaker Village. In his last years, beginning in 2015, David superintended excavations at Enfield (N.H.) Shaker Village. David's close study of the Shakers' constructed reservoirs and water-powered mills cemented his specialization in industrial archeology and Shaker studies and led to numerous publications, including his book *Neither Plain nor Simple: New Perspectives on the Canterbury Shakers* (2004), which provided the first artifact-based portrayal of this celibate American sect.

In partnership with a colleague, the late William L. Taylor of Plymouth State University, David participated in the first recordation of the Concord (N.H.) Gasholder, the most intact gasholder house in the U.S. and the focus of a current preservation effort that David was following closely (see article in this issue). At a meeting held at this site in 1980, he co-founded the Northern New England Chapter of the SIA. David summed up his work in New Hampshire and paid tribute to his predecessors and colleagues in the book *The Archeology of New Hampshire: Exploring 10,000 Years in the Granite State* (2006).

David served the field of industrial archeology in another important way. From 1983 to 1994, he ably served as editor of *IA*. Closer to home and ending only at his death, David edited the newsletter of the New England Chapters of SIA and *The New Hampshire Archeologist*, the journal of the New Hampshire Archeological Society. He also chaired the N.H. State Historic Preservation Review Board.

David's service to the field of industrial archeology and to the region centered on Plymouth, N.H., was only half of his life. The other half centered on Chestertown, N.Y., the site of a farm that had been in his family since 1794. David traveled back to his beloved farm on most weekends, and sometimes more often, usually making the 3 1/2 hour trip at night and giving rise to the widespread belief that he never slept. His productive archeological life in New York focused on explorations of military sites from the French and Indian War. His excavations at Fort William Henry, Battleground State Park in Lake George, Rogers Island in Fort Edward, and Saratoga National Historical Park resulted in many books and articles, notably *The Great Warpath: British Military Sites from Albany to Crown Point* (1999) and *Rangers and Redcoats on the Hudson: Exploring the Past on Rogers Island, the Birthplace of the U.S. Army Rangers* (2004). David's writing was always accessible and conversational, opening the worlds of history and archeology to the lay reader as well as the professional. David's published works, of astonishing breadth, are matched by his legacy as a teacher, lecturer, field archeologist, and editor.

David Starbuck. Credit: Jon Gilbert Fox

NNEC Fall Tour Report

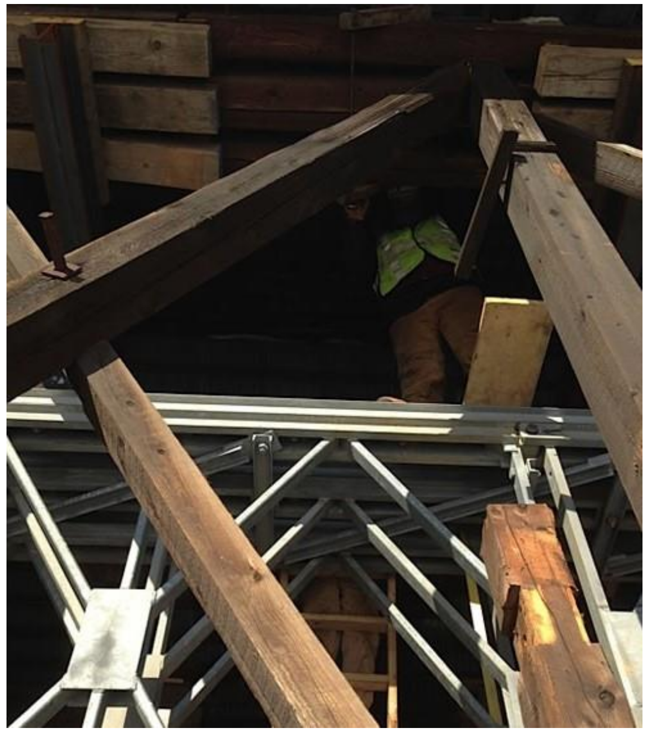
This was a perfect foliage day in Campton, NH. About 35 of us met at the Blair Covered Bridge.

This bridge was previously restored in the 1980s. It then had a major restoration and load upgrade in 2013-2014. This time it had to be able to carry heavy fire trucks and other emergency vehicles. This generated a great amount of work for the contractor but may not have been worth the hassle of being under government scrutiny.

The contractor was our presenter, Arnold Milton Graton, a noted covered bridge rebuilder. Arnold Graton and Meg displayed pictures showing every stage, and details, of the rebuild. They explained each step with the reasons why it was done that way. A most interesting requirement was the insertion of a prefabricated metal frame through the length of the bridge and out the ends to support the weight of the entire bridge while they rebuilt it.

The many details were very interesting and too much to write down for a report like this. Members really need to come to these tours to gain the benefits of these presentations.

The website of Arnold M. Graton Associates describes the firm's 50 years' experience in covered bridge work. They have built 16 new covered bridges, restored 65 covered bridges and 2 iron truss bridges.

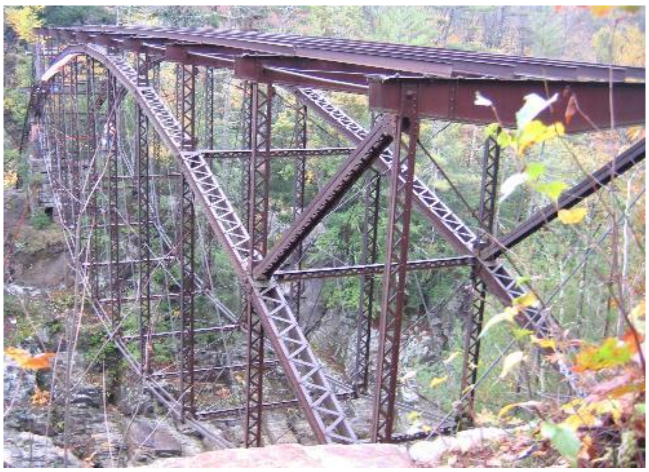


The bridge and steel truss supporting it. Note the worker in the upper right.

Livermore Falls is the site of the old pumpkinseed bridge and the remnants of a pulp mill.

"Livermore Falls Gorge, however, has a long history of industrial activity. Because the falls lent themselves well to the generation of waterpower, the gorge proved attractive to enterprising industrialists. From the earliest period of Euro-American settlement, the falls provided a power source for the processing of grain and wool. These early mills later gave way to industrial pursuits that served a market outside of the local area, including pulp milling. The milling activity at the falls spawned a small village on the east bank of the river, south of the falls. Located in the river bottom, the community came to be known as the "Hollow." The Hollow was the site of numerous mills, a tannery, and a state fish hatchery. These pursuits, in turn, fostered the construction of dwellings, a boarding house, stores, a schoolhouse, and many outbuildings." *Prepared for State of New Hampshire Department of Resources and Economic Development, Division of Parks and Recreation, Prepared by Gray & Pape, Inc. 60 Valley Street Providence, RI. 02909 December 22, 2015*

We stood right over the end edge of the pumpkinseed bridge frame (risking a slip and fall) to see the detailed construction up close. This under-deck, twin-upper and lower Lenticular Truss Bridge may be the only surviving one of its kind remaining in New Hampshire. Here are two photos of the bridge.



[Editor's note: in the closeup, it is possible to see that the bottom chord is of lightweight construction, while the top chord is a typical laced beam. The lightweight construction of the bottom chord is possible because it is under tension only]

From there we walked down to the old pulp mill foundation. Standing on top, we looked down inside where the rushing water used to power the mill. Also, from that vantage point we could look back at the bridge, and out across the majestic gorge.

The foundations of the pulp mill

Lunch was at The Common Man restaurant, which was built on the site of the old Kearsarge Peg Mill. It was established in 1898. This mill used to make wooden shoe pegs. They were used worldwide in shoe manufacturing. The Kearsarge Peg Mill produced 300 bushels per day of split wooden shoe pegs. This required 2500 cord of yellow birch per year. The mill's waste wood was used to fuel its 100 horsepower boilers. So, they were energy independent. The mill closed after WW!; other wooden products were produced until 2001.

After lunch, we visited the now repurposed Dole Woolen Mill. "For more than 100 years, the Dole Family ran a profitable woolen mill in Campton, making heavy pants for loggers, and socks and leggings for soldiers in World War II. The mill has been dormant since 1965, but a few years ago a young local couple bought it and transformed the mill into something unexpected.

In 2017, Jessye and Sky Bartlett purchased Mill, renovated the structure, and gradually turned it into a game and hobby building. They sub lease most of the space to other game enthusiasts.

"It was the Dole's right up from 1826 to 1965 which made it the oldest family-owned woolen mill continuously running in the U.S., and they were the third oldest in the country." *Credit: America's Textile Reporter*

Sally Dole Harris' father was the principal marketer for the mill in the 1930s, traveling to Maine and Massachusetts to find outlets for the mill's woolen goods. "I don't know if you've heard about the Dole Pants. Real heavy wool. And they made them here and they sold them all over New England and the lumber jacks used them," Dole Harris says. "And they made socks and they made sweaters and they made earmuffs for skiing." *Credit: Sean Hurley – N H Public Radio*

Roland Gooch says these socks were most likely used by soldiers during World War II. "During the war - course all the men were away," Gooch says. "They made all kinds of things for the Army and Navy. Socks and sweaters and things." The new owners, Jessye and Sky Bartlett now host a monthly contradance on the second floor of the mill where Joyce Mayhew once tied wool and her friend turned socks inside out.

Tour outside the Dole Woolen Mill

Finally, to the remnants of the largest bobbin manufacturing facility in the world. What was commonly known as Beebe River, the company town. "The Beebe River Mill, in Campton, was built in 1917, to harvest the timber in the Squam and Sandwich ranges. It was operated by the Woodstock Lumber Co. and Parker Young. A whole town was built, with houses for the workers, a company store, boarding house, movie theatre, and of course, a large new sawmill. The mill complex had been bought by The Draper Mills Corporation in 1926, to be used for the production of bobbins for Draper's textile mills and for sale to other textile companies. While it was owned and operated by the Parker Young Company it was fully integrated with the Lincoln complex, with raw materials, finished goods, scrap, and supplies moving back and forth on the East Branch and Lincoln Railroad, also fully owned by Parker Young and operating on the Boston and Maine RR track. In addition, an extensive logging railroad operated from the Beebe River mill into the surrounding forests, to supply the mill." *Used with permission of Rick Russack*.

In 1967, the Draper Mills Corporations was taken over by Rockwell International. About 1970, it was closed, along with Draper's Massachusetts main textile machinery manufacturing plant. Textile machinery was being made in Japan at much lower manufacturing cost. *A personal note*: David Dunning worked at the Campton plant in the summer of 1969. Home from college, he unloaded bobbin blanks from railroad cars using a Bobcat loader. It was tight quarters maneuvering that inside of those box cars.

[*Editor's Note: This editor believes the layout of New England mills, arranged for rail freight, is one of the causes of the demise of the New England Textile industry. After watching the ease with which fork trucks load tractor trailers, the extra cost of rail freight becomes obvious.]*

Remains of the bobbin plant

After visiting what was left (very little) of this once great mill town, we went to the Campton Historical Society building. There our host, Paul Yelle, had pictures and samples from the bobbin plant and he also showed slides for us. While there, we also explored the society's collection of interesting memorabilia in their main building and shed.

Campton Historical Society building

Diversion of the Charles River into Mill Creek in Dedham, forming the Mother Brook

Robert W. Timmerman

Part 1: History

The need to divert the Charles River to augment the flow in the Mill Creek came from the need for a grist mill in Dedham, MA, founded in 1636. In 1637, Abraham Shawe proposed to build a mill in Dedham, the Town giving him 60 acres in return. He died in 1638, without completing the mill.

In 1639, the Town formed a committee to consider where to build a mill. Someone on the committee proposed to build a channel connecting the Charles River with what was then called the East Brook, which drained into the Neponset River. On March 25, 1639, the Town ordered that the work be done as a work by the whole Town. [1] Worthington states: "The natural features of the territory lent themselves very easily to this plan, as can be seen by inspection, and a very little labor was required to accomplish this object." [2]

There is some speculation that this idea was the brainchild of one of the Dedham settlers who came from East Anglia, a low-lying area in the east of England where using dikes and ditches to manipulate water levels had a long history. The drainage of the Great Fens in Cambridgeshire and Norfolk was completed in the 1630s, just as the settlers had been preparing to leave for America, so these settlers may have had a passing acquaintance with hydraulics. It was completed July 14, 1641 [3]

"East Brook was a small stream which began about 100 rods (1 rod= 16.5 feet, so 100 rods= 1650 feet) East of Washington Street, in the rear of what is now the Brookdale Cemetery and followed the present course of the Mother Brook into the Neponset River." From Google Earth it is possible to estimate the distance to Washington Street, which works out to about 2200 feet, making to total distance 3850 feet, or close to the popularly quoted 4000 foot distance.

A later section of this paper will discuss how much labor it likely took.

The Charles River is marshy on both sides of the entrance to the Mother Brook The first water privilege was located where Bussey Street crosses the Mother Brook. The dam is hardly visible today.

Mother Brook leaving the Charles River, crossing Under Route 1 opposite the Dedham Mall

In 1641, John Elderkin, of Lynn, accepted the offer of the Town to build a mill, and built a grist mill on that site, providing the residents of the Town with a means to grind their corn, 5 years after the Town was founded.

This mill was bought and sold a number of times until about 1653, when Mr. Nathaniel Whiting became the sole owner. The site remained in the Whiting family until the 1820s. In 1664, an additional mill was needed, and the Town gave Daniel Pond and Ezra Morse the right to erect a mill above Mr. Whiting's mill, which was to be finished by June 24, 1665. This new mill, the second privilege, was located were the Alimed plant now stands, at the intersection of High and Maverick Streets, and where Maverick Street crosses the Brook

The location of this new mill upstream of his mill caused complaints from Mr. Whiting about the new dam reducing the water flow to his mill. In 1666, the Town required Mr. Morse to make sure that the level of his dam did not interfere with the flow of water downstream. It would appear that Mr. Whiting's dam was not completely tight, as the Town also required him to make sure it was tight before complaining of lack of water. There resulted a lawsuit between Morse and Whiting over water rights, which Morse lost. [4] The picture below shows the location of the first two mill privileges

Location of the first two mills. River runs left to right, so second mill is upstream of the first, leading to 40 years of trouble. Site of dam for first mill is underwater.

While this was going on, Johnathan Fairbanks and James Draper requested a water privilege to build a fulling mill [5] (a fulling mill uses machinery, water powered at the time, to pound and clean hand-woven woolen cloth) below Whiting's mill, at a location where Sawmill Lane crosses the Mother Brook. This was the first textile related mill on the Brook; the building remaining until at least 1868, when it was seen in an early photograph. [6]

For people looking for it today, it is a rather curious intersection, because both of the cross streets change their names at this point: parallel to the brook, Bessey Street becomes Milton Street, and perpendicular to the brook, Dedham Boulevard stops at the water's edge, and becomes Sawmill Lane, which crosses the bridge and continues 250 feet to the intersection, where it becomes High Street. In addition to the change of street names, positive identification of this intersection is the Dunkin Donuts on the corner. The Town, mindful of the disputes between Whiting and Morse, requested that Whiting replace Fairbanks in this water privilege. In 1682, the fulling mill was constructed, which marks the third privilege on the Brook. The Whiting descendants held this for nearly two centuries. [7]

The feud between Morse and Whiting continued for nearly 40 years, until in 1699, the Town ended it by removing the Morse Dam. In 1700, other parties erected a tannery on the site.

The fourth privilege was developed at present day Stone Mill Lane in 1797 by members of the Whiting family. Initially it produced copper pennies, but in 1790 it was redeveloped into a paper mill, and then into a wire mill.

Below is a view of the fourth privilege after a textile mill had been built on the site.

The fourth privilege is in the foreground, and the location of the third privilege is in the background.

The fifth privilege was developed in 1814, at the intersection of River Street and Knight Street, in the Readville section of Boston, just before the Mother Brook joined the Neponset River.[8] [9]

The Mother Brook runs left to right, while the Neponset River enters from the bottom.

With dams at all the mill privileges in place, entrepreneurs began seeking ways to use the water in the Mother Brook, the only source of power at the time, to drive ever larger mills. Benjamin Bussey bought both the first and second privileges in the 1820s, and erected new brick factories at both locations, which operated as the Dedham Woolen Mills. Also in the1820s, various properties at the fourth privilege were consolidated, and a new stone mill was built in 1835. That building still stands today, but has been converted to condominiums. [10]

As a final note on the development of water power, in about 1885, the third privilege was merged with the fourth, and operated as one fall at the fourth privilege. [11]

Readers seeking more information on the development of the mills may find some of it on the website of the Dedham Historical Society. *info@dedhamhistorical.org*

Part 2: The fight over diversion of water

This diversion of water from the Charles River began to cause trouble as mills were developed along the Charles. Worthington states: "The diversion of the Charles River in part though this stream began to cause trouble at an early date. The value of the stream to the manufacturers was great, and it is undoubtedly true that the original channel was deepened and widened from time to time by the efforts of those owning privileges upon the stream. The waters upon the meadows along the meadows along the Charles River appear to have been a subject of great interest to the townspeople during the later part of the 17th century. The mill owners upon the Charles River below also began to find fault with the diversion of the water of the Charles River through Mill Creek." [12]

The following is a paraphrase and condensation of the account in Worthington. The mill owners appealed to the Commissioners of Sewers; in 1767 they made a report on removing obstructions which caused overflowing of lands in Roxbury, Newton, Dedham, and Needham, and filed it with the records in the State House. It also appears that they fixed a sill in Mill Creek, which was agreed by all parties. In order to protect their rights, the mill owners on the Charles River incorporated themselves in 1797 (act approved in 1798). In response, the mill owners along the Mill Creek (later Mother Brook) and Neponset River incorporated (act approved in 1798).

Diversion of water between the lower Charles River and Mill Creek (henceforth Mother Brook) became a real question in 1809, and the two corporations petitioned the Supreme [Judicial] Court once again for appointment of Commissioners of Sewers to determine the proper amount of water to be diverted. At this point, all but the fifth privilege had been developed, and mill owners along the Mother Brook were likely eager for more water.

The Commissioners prepared a report dated September 30, 1813, but it was not filed with the Court until 12 years later. The Proprietors on Mother Brook objected to it because of certain evidence from the report of 1767 which was omitted, and the gap in time from completion of the report until filing. The Court sustained their objections, and set aside the report in 1826.

A committee met in 1825 to consider diversion of the Charles into the Mother Brook, the proprietors assembled to consider the issue of diversion, but accomplished nothing. In 1829, yet another committee was chosen to confer with the Proprietors of Mills on the Charles River. Both groups of Proprietors of Mills met again in 1830 and in 1831, and finally, on Dec. 8, 1831, they entered into an agreement between the Proprietors on the Mill Creek (Mother Brook) and Neponset River, and the Proprietors of Mills on the Charles River, that one third of the water should go to the Mother Brook (Mill Creek), and two thirds to the lower Charles River. [13]

Worthington states that this agreement was filed with the Norfolk County Records, and is still in force today [1900]. [14] Today, the Mother Brook is maintained to control floodwaters in the Charles River. [15] There is a walking trail around part of the Mother Brook today.

Part 3: Reverse Engineering the Canal

This canal was originally dug to power one grist mill. The next mill to be added was another proposed grist mill *upstream* of the initial one, which shows that there was plenty of head available, despite the long standing feud between Whiting and Morse.

How much power does a grist mill take? There are a number of ways to approach the problem, it is good practice to evaluate all of them and compare results. Here is a picture of the grist mill at Plimoth Patuxet Museums (formerly Plimoth Plantation):

This wheel is about 4 feet wide, and perhaps 12 feet in diameter. When the picture was taken, the wheel was turning, but not driving a load, so most of the water was going out the sluiceway. One can make a rough guess at the flow by assuming that the sluiceway is also 4 feet wide, that the water flowing over the sluice is probably 6 inches deep, and probably has a velocity of maybe 3 feet per second, judging from how far the water falls. Doing a bit of arithmetic, the flow is about 6 cubic feet per second.

Water enters the wheel at about the center, so it falls roughly 6 feet. The power developed is about 4 hp.

Another way to look at the problem is to use data on water wheels from the website of Historic Bethlehem (PA), Colonial America's Pre-Industrial Age of Wood and Water. [16] They describe overshot wheels as being at least 10 feet in diameter, and developing 4 to 5 hp but not more than 10 hp. For this site, the head is about 5'-6.4" [17] In order to make 4 hp, which is about what the mill at Plimoth requires, a flow of about 6.4 cubic feet per second. Round up to 10 cubic feet per second.

Digging a ditch by hand today is hard work, in the 1640s, it was even harder work, because we did not have good shovels. America's leading shovel maker, the blacksmith Oliver Ames, did not start making iron or steel shovels as a business until 1774. [18] Before forged steel or wrought iron shovels were available, shovels were made from wood, by carving the whole thing from a large tree branch, and facing the cutting edge with wrought iron. [19] Having used various types of shovels, this author believes that trying to dig with a spade made like this would be a slow process, to be done as little as possible. If these settlers had any experience with digging ditches, they would have dug the smallest ditch possible, and allowed people coming later and needing more water power to enlarge it.

How big a ditch would convey 10 cubic feet per second to the first mill location? It is necessary to make some assumptions:

Assume that the grade of the original Mill Creek is sufficient to get the water from the new ditch to the mill site.

Assume a drop in elevation from the start of the new ditch at the Charles River to where it joins the existing ditch of one foot. This is a gradient of 1 in 4000. The ditch would be dug half as deep as it is wide. This would reduce caving, and also, reduce problems with running into rocks.

The flow in an open channel can be calculated with the Manning formula applied to open channels. [20] To carry 10 CFS, a ditch of about 4.5 feet wide and 2.25 feet deep would be required. To provide a factor of safety, assume the ditch is 5 feet wide and 2.5 feet deep. The amount of soil to be excavated would 2083 cubic yards

The amount of labor to excavate that much soil by hand can be estimated from standard construction estimating handbooks. I have used the RS Means handbook, for heavy soil; even if the excavation is light soil, the tools available in 1639 were nowhere near a good as we have today. [Having used a modern round point shovel, this author can state that it is an efficient digging tool for hand excavation, one can only imagine how slow it would be to dig even loose soil with a steel tipped wooden spade.] The quality of tools will come into play later when enlarging the canal, and the waterway of the Mother Brook is considered. The estimating handbook gives a productivity of 4 cubic yards excavated in an 8 hour day, or 0.5 cubic yards per labor hour. [21]

Back then, one can assume that the settlers worked 12 hours per day, 6 day per week, or 72 hours per week. From this, we can calculate that it would take one person about 58 weeks to excavate the canal. This is not the whole story, as the canal runs through virgin woodland; clearing the woods and grubbing out tree roots would probably take as much time as digging the canal. This puts the total construction time at 116 weeks for one person, or about 2.25 years.

Digging the canal was supposed to be a project of the whole town, which contained about 30 families [22]. Out of those thirty families, one might get labor from one sixth, or 5 people at one time. Dividing the labor of 116 weeks by 5, we get a guess of a more reasonable 23 weeks. The actual time to complete was just shy of 2 years, 4 months. One has to consider that the labor force might be lesser than 5 people, and that digging would stop in winter when the ground is frozen. Frozen ground would not stop clearing for the path of the canal, indeed, clearing and hauling cut down trees away would be easier over frozen ground. While digging the canal would be a struggle, it does not appear to have been a huge strain on resources.

Things changed in 1774, when Oliver Ames started making shovels in his blacksmith shop, and later, around 1805, when his sons started making shovels in quantity. [23] With reasonably good shovels available, and the larger workforce available at the time, it would be feasible for a large labor gang to enlarge the canal, and the whole Mother Brook.

The channel from the Charles River to the Mill Creek was originally built by the early settlers to provide waterpower to the one vital mill for a 17th century village, a grist mill, to grind corn into flour for baking. Over the years, additional mills were built along the Mother Brook, until in the late 19th century, it powered a number of textile mills. This resource of readily available hydropower was sufficiently valuable to cause a number of legal skirmishes, both between mill owners along the Mother Brook, and between the mill owners along the Mother Brook and the mill owners on the Charles River, downstream of the Mother Brook.

As the amount of hydropower available from the local river pales in significance to that obtainable from the power grid, the Mother Brook has retained a useful role in management of the flow in the Charles River, and bypassing excess flow in the Charles into the Neponset River.

Notes:

The principal source for the history of Mother Brook is Worthington, Erastus, *Historical Sketch of Mother Brook, 1639 to 1900*, Dedham, MA, Press of C. H. Wheeler, 1900. This book has been scanned by Google, Google Books, Historical Sketch of Mother Brook: henceforth Worthington. Much of the history is directly from Worthington. It will be footnoted in general, and for specific quotes.

In addition, the Dedham Historical Society did a series of articles in the *Dedham Times*, in celebration of the 375th anniversary of the Mother Brook. They can be found on their website. Many of these quote Worthington, but some present a different viewpoint, which will be noted here: info@dedhamhistorical.org

I have visited some of the sites on the ground, but find that the aerial views from Google Earth are superior for showing locations.

[1] Worthington pgs 1, 2

[2] Worthington, pg 2

[3] There is a series of 5 articles on the Dedham Historical Society website, https://dedhamhistorical.org about the Mother Brook.

Neiswander, Judy, *Tales from the Mother Brook, Part 1, Beginnings,* published in the *Dedham Times*, April 17, 2020
[4] Worthington pgs 2-4
[5] Worthington, pg 4
[6]] Neiswander, Judy, *Tales from the Mother Brook, Part 2, The Five Privileges,* Originally published in the *Dedham Times*, April 24, 2020
[7] Worthington pg 4
[8] Neiswander, Judy, *Tales from the Mother Brook, Part 2, The Five Privileges,* originally published in the *Dedham Times*, April 24, 2020
[9] Worthington pg 7
[10] Neiswander, Judy, *Tales from the Mother Brook, Part 3, The Early Mills,* originally published in the *Dedham Times*, May 1, 2020
[11] Worthington, pg 12
[12] Worthington pg 7
[13] Worthington, pgs 7-11
[14] Worthington, pg 11
[15] New England Historical Society Website
[16] Website of Historic Bethlehem (PA)
[17] Worthington, pg 14, the first privilege is the second dam on the brook.
[18] Amesfreelibrary.org/ames-shovel-company-chronology
[19] Salman, R.A*., Dictionary of Tools used in the woodworking and allied trades 1700-1970* New York Macmillan, 1975, pg 470
[20] See, for example, Merritt, Frederick S, *Standard Handbook for Civil Engineers, Second Edition,* New York, McGraw-Hill, 1975, pages 21-42 to 21-46
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Demolition of the Nation's Pioneer Windowless Factory: Simonds Saw in Fitchburg, Mass.

Sara E. Wermiel

In 2019, Simonds Saw, manufacturer most recently of metal cutting saw and file products, closed their historically significant factory on Intervale Road in Fitchburg and sold it. What made this building special was that it was a very early – indeed, generally considered the first in the U.S. – example of a windowless factory, with artificial lighting and mechanical ventilation, cooling, and humidification. Constructed in the 1930s, this sprawling one-story plant was very different from the multi-story loft buildings and monitor-roofed production sheds the company had occupied in downtown Fitchburg. Simonds Saw called its new factory a "Controlled Conditions" plant: "Air, Light, Heat, Humidity and Sound ALL CONTROLLED." (Fig. 1) The building was a forerunner of the large, one-story buildings with controlled interior conditions that became commonplace for manufacturing, warehousing, retail, etc. Until this summer, the building stood intact. Regrettably, the factory's new owners demolished it. It will be replaced with a one-story, enclosed building, for an Amazon distribution center.

History and form of Simonds Saw's windowless factory

In 2016, I visited the factory and walked around the outside, in connection with research I am doing on the history of production sheds. The most visibly distinctive features of the building were its vastness and lack of windows. As noted above, a large windowless building is hardly remarkable today, but when the building was designed, 1929-1930, the prevailing notion of what made a good environment for work was abundant natural light. While architects had tossed the idea of windowless buildings around, the concept had been little tried; for manufacturing, daylight factories were in vogue. However, factories built with large windows had drawbacks: uneven lighting; glare; heat gain; and air, noise, and dirt infiltration. Hence an alternative: a controlled building environment.

Simonds Saw took a chance in being the first to order such a plant. Designed and constructed by The Austin Co., a design/build firm the specialized in industrial buildings, the factory was built in two phases. Plans were filed with the Commonwealth in Dec. 1930 and construction began in 1931. However, financial difficulties during the Great Depression stalled the project. Construction resumed in 1938, and the plant was completed the following year. During that interval, developments in air-conditioning and lighting allowed the plant to install better equipment than was available in 1931.

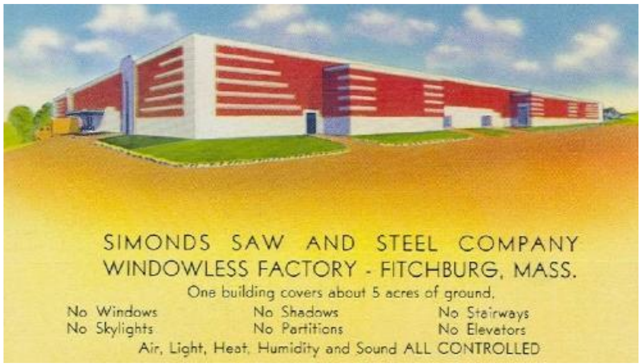

Fig. 1. Drawing of Simonds Saw plant, Intervale Rd., Fitchburg, Mass., showing front (north) and east facades.

Originally, the new building was a large rectangle (360 by 560 feet) with four small additions projecting from the long east and west sides (two per side), which contained toilets, changing rooms, a clinic, storage, and mechanical equipment. The structure had a steel frame and solid, brick-faced enclosing walls. The roof frame was welded steel trusses, designed to increase the clear span and minimize the number of interior columns. The roof deck was covered with cork and fiber insulating board, principally to reduce noise and vibration, but also to reduce heat loss and gain.

The walls were an interesting combination of rough, red bricks and smooth enameled buff bricks, in a streamlined design. Later additions to the main building were also faced in red and buff bricks and done in a way that continued the original architecture. (Fig.s 2 & 3)

All the production operations of this metalworking company took place in this building The complexities of building an enclosed plant for this kind of business were great: gases and particles had to be vented to the outdoors; air had to be cleaned and cooled; sound had to be controlled; proper light, power, and special services (exhaust fans, etc.) had to be supplied to each of the approximately 1,000 machines set in lines through the building.

Fig. 3. Simonds Saw plant, aerial view, with a new office building addition on the front right.

Fig. 2. Simonds Saw plant, Intervale Rd., Fitchburg showing the front (north) and east facades, in 2016. The one-story structure on the front left was added after original construction.

Fig. 4. East side of the Simonds Saw factory and a corrugated metal-enclosed shed (left).

Simonds Saw's long life in Fitchburg

The company traced its start to 1832, when Abel Simonds manufactured scythes and edge tools in West Fitchburg. According to a local history, his sons took over the business in 1864, as Simonds Brothers & Co., and made a variety of cutting products. In 1868, Simonds Manufacturing Co. was incorporated and started what came to be extensive works in downtown Fitchburg, at Main Street between Willow and North streets. The company shifted its line of manufacture to saws and knives. Members of the Simonds family opened other metal products businesses in Fitchburg, and the companies had branches and licensees in other U.S. cities and Canada. (Fig. 5)

In 1939, the company, then called Simonds Saw and Steel Co., moved its machinery and operations from their downtown Fitchburg plant to the new factory on Intervale Road. The lofts and sheds of the downtown site were demolished some years ago, save for a 3-story loft building at 26 Willow/45 North St. (This building has been adaptively reused, converted to student housing.)

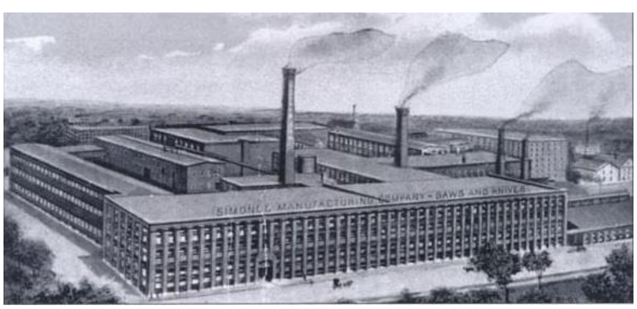

Fig. 5. Simonds Manufacturing Co. former plant in downtown Fitchburg, at Main St. between North and Willow streets.

And now Simonds Saw's great windowless factory is gone too.

Why was the building demolished and not reused? According to Fitchburg's Director of Economic Development, "several market-based factors led to demolition and new construction." I am not aware that anyone advocated for its preservation. The remains of Simonds' downtown plant were recorded by HABS before the city demolished it. The landmark Intervale Rd. plant was not recorded.

A Century of Generating Electricity for Boston's Mass Transit

Gilmore Cooke

Introduction

The 'T' owned and operated a large electric power system consisting of electric generators, steam engines, steam boilers and supporting auxiliaries for nearly a century. It began generating its own electricity because there was no other way to obtain the required electricity. Beginning in 1889 the MBTA and its predecessors, the West End Street Railway Company, also known as the Boston Elevated Railway, built a large electrical power system necessary to support their passenger transportation business. There came a time however when the traction company had to stop generating its own electricity in favor of plugging into the Boston Edison power grid. We will briefly examine the evolution of this electrical power system that was recognized as a Milestone by the IEEE - Institute of Electrical & Electronic Engineers.

A brief history of Boston's Electrical Transit Power System

The West End Street Railway Company successfully engineered and established the first and largest electrical power project of the time. This historically significant power system sustained growth and numerous changes over time. Built from 1889, Central Power Station (CPS) was a huge engineering achievement benefiting the citizens of Greater Boston. CPS was built by the new street railway enterprise to provide DC (direct current) electricity for the growing streetcar system in Boston. Located in Boston, CPS became the largest electrical power plant in the world at that time. From its central power plant, the West End Street Railway Company was able to launch the largest electrical traction system. CPS went on line in 1891 and within a few years, the 9000 horses that had dragged passengers around the region were retired, replaced by 1000 shiny new electric streetcars.

CPS Description

The original central power generating station consisted of four rows of the largest belt driven electrical generators ever made (see Photo 1) 250 kW, 600-volt direct current traction type generators. These machines were driven by six of the world's largest prime-movers made, a 2000 hp triple expansion Corliss steam engines, manufactured by EP Ellis of Milwaukee. This was the Best Available Technology at the time, featuring flywheels, belt driven countershafts, belt tighteners, quill shafts and friction clutches. An explanation of the manual steps necessary to engage and disengage one lineup of generators over to another steam engine was complicated, far beyond the scope of this article. At that time, GE engineers were designing a larger direct-coupled generator, one that was successfully displayed at the Chicago Fair in 1893.

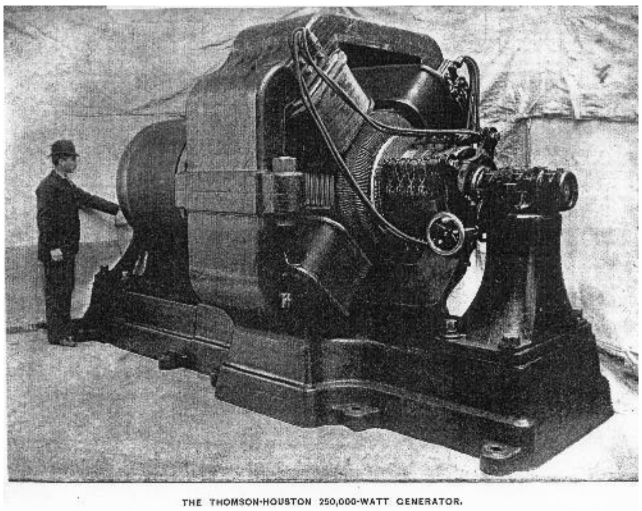

Photo 1: The Thompson Houston 250-kilowatt belt driven generator was a four-pole 600 volts DC machine. Engineered and specified by West End Street Railway engineers, it was manufactured in Lynn by Thomson – Houston, predecessor of General Electric Company. This represented a triple increase in generator kw rating.

These units were acquired, and CPS underwent a major change in order to accommodate these larger generators seen in Photo 2.

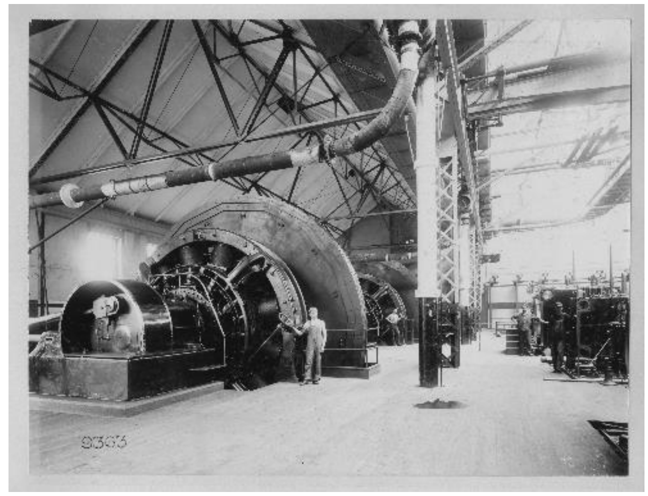

Photo 2: Central Power Station was upgraded by removing line-shafts and belt-driven generators to accommodate GE's largest direct-coupled DC generators.

The DC Network

As transit service reached further into the suburbs, new power stations were added. By1897 there were 7 DC generating stations: Allston Power Station, Central Power Station, Harvard. and others at East Boston, Dorchester, Charlestown, and East Cambridge.

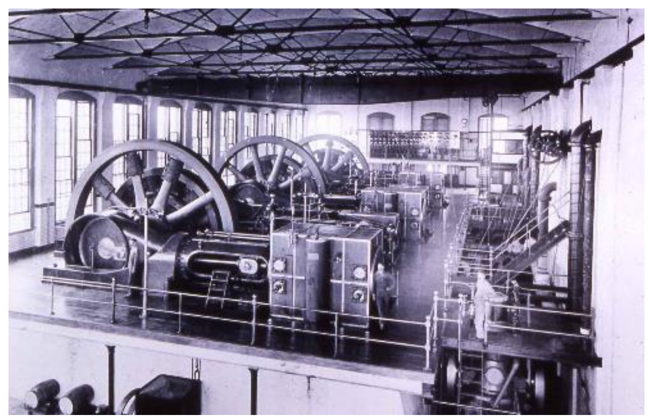

Photo 3: Harvard Power Station with three horizontal reciprocating steam engines, each coupled to a DC generator and flywheel.

A typical station in Photo 3 had the latest horizontal steam engines with coupled generators. These power plants were interconnected for operating loads at 550 volt DC. The whole system was divided into multiple feeder sections controlled by switches and circuit breakers at several of the plants. Sections were connected to parallel stations for load sharing, redundancy, and to improve efficiencies.

The Boston Elevated Railway

By 1904, the operations of the surface tramway lines, the elevated lines, including a small subway system, were integrated. Electrically, the Boston Elevated Railway Company built their large DC traction power plant at Lincoln Power Station. It was connected to a Corliss steam engine arranged vertically as shown in Photo 4. Unlike New York City where transit companies operated independently from each other, each with their own power supply, Boston had one integrated or common electric power supply. The overall transit system then consisted of 421 miles of tramway tracks, and 16 miles of elevated tracks, all within a radius of seven miles from downtown Boston.

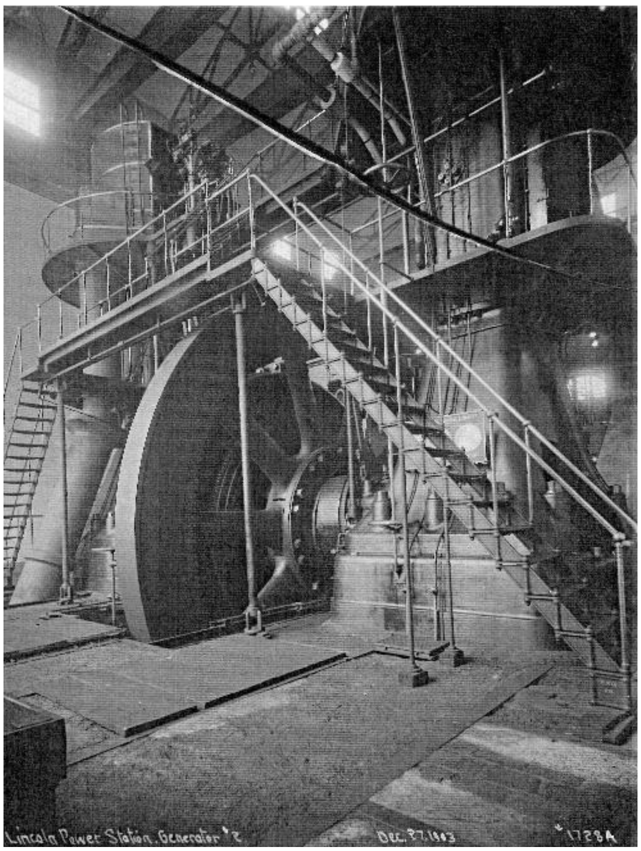

Photo 4: Lincoln Power Station. This vertical reciprocating steam engine with generator was removed from service in 1931 to make way for new rotary converters.

In 1904 the transit company had 1550 closed tramway cars, plus a similar number of open cars and 174 elevated cars. There were eight generating stations using the 550 volts direct current, track return system.

Converting to 25 Cycles Electricity

Engineering plans by Stone & Webster Engineering Company were approved in 1911. These plans involved replacing the old DC system. A new AC central power station was specified with feeders connected to multiple rotary convertors. There were three reasons for wanting to do this: first, the company needed more electricity for their expanding business; secondly, the original steam boilers and equipment needed replacement or costly repairs; third, there was the problem of supplying fuel to a growing transit system. Transporting coal from storage located on the Fort Point Channel to the suburbs was the deal breaker, because coal was distributed at night using special trolley cars.

South Boston Power Station aka SBPS

The next phase in the evolution of Boston's traction power system was converting to 25 cycles per second. SBPS, a beautiful, modern central AC power generating station, was built in South Boston close to the Reserve Channel. The Reserve Channel provided water for condensing purposes as well as facilities for unloading coal cargo ships. SBPS transmitted 13.2 kv, 3- phase, 25 cycles to a series of synchronous or rotary converter substations.

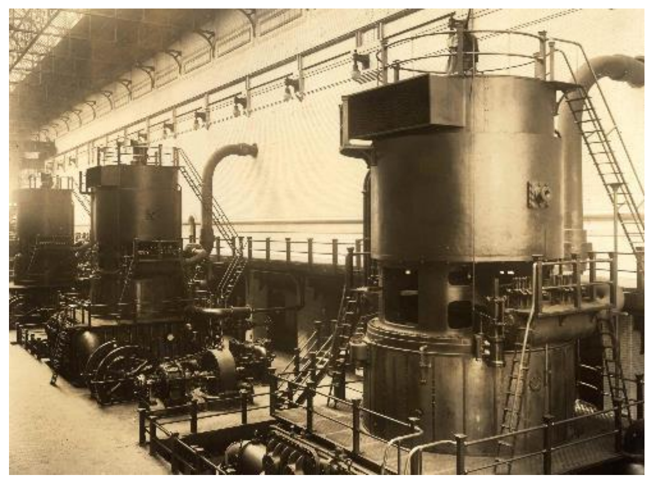

Photo 5: SBPS featured three of the largest Curtis vertical steam turbines manufactured by General Electric, rated 15,000 kw, 25 cycles. Later, two more larger steam turbine generators were installed; horizontal units mounted on concrete pedestal.

This conversion from direct current to alternating current began in 1911. Six rotary substations similar to Photo 6 were commissioned during 1911 and 1912: at Coolidge, Kendall, East Boston, Arlington, Malden and Roslindale.

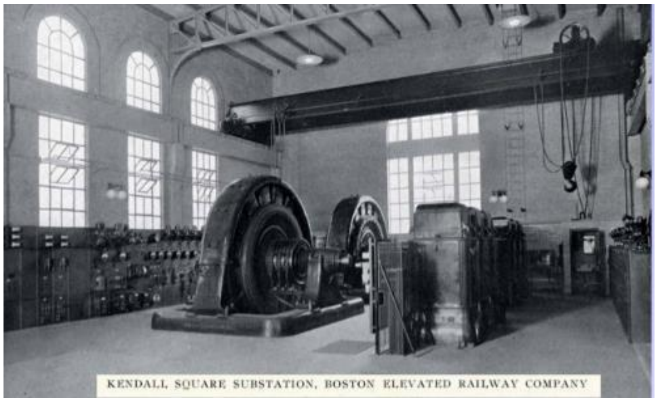

Photo 6: A typical synchronous or rotary converter substation with General Electric equipment. Rotaries transformed incoming 13,000 volt, 3-phase, 25 cycles, to 600-volt DC supplied to trolley lines or third rails.

The End Game

Transit loads continued to increase from 31 megawatts in 1902, to approximately 50 megawatts. During the period 1911 through 1931, traction feeders were transferred from the original DC network over to the new AC SBPS network. By 1931, there were 14 rotary substations in service. By the 1970's, the power system was in need of costly repairs and replacement of corroded or obsolete equipment. In 1981 the 'T' decided to shut down its power generating capabilities and buy electricity instead by connecting to the Edison Electric grid. SBPS was demolished soon afterwards. In closing, readers are reminded that CPS is still with us: take a look at Photo 7. SoWa, a local association, has completely renovated the main building to host weddings, fundraisers, and public events.

Photo 7: CPS is now the SoWa Power Station at 540 Harrison Ave. Image by Google.

Photographs:

Photo # 3: courtesy of Cambridge Historical Commission, Cambridge MA

Photo # 2 & 5: courtesy of General Electric Co. Collection, Schenectady NY

Photo # 4: courtesy of the Seashore Trolley Museum

Photo # 7 from Google Earth

Others were copied from Stone & Webster Company brochures

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"Power System of Boston's Rapid Transit: Its Development, Historic Significance and Contributions". By Gilmore Cooke, November 2004. Available from the IEEE website.

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Northern Heritage Mills Records the Preservation of Industrial Items and a New Hampshire Native American Ceremonial Stone Structure

Gerry DeMuro, Northern Heritage Mills

Early Iron House Moving Wheels Preserved

In 1940 Mr. Peter Rubchinuk started a farm, sawmill and a heavy equipment moving business in Middletown, MA. An original set of his solid iron house-moving wheels or trucks are being preserved in a family exhibit in Unity, NH which includes the two sets of four iron wheels or "trucks".

House moving wheels on a truck

The wheels are 12 inches wide and two feet in diameter made of 3/4inch solid iron with two sets of nine spokes each 9/16-inch thick on a nine-inch hub separated from the other hub by four inches. The metal-on-metal bearings are ten inches wide with one large grease cup. The trucks are hand made from two 12-inch I-beams with welded and bolted ½ inch steel plate boxing the sides. Each truck is six feet long and four feet wide. On top center there is a fifth wheel with a vertical pointed six-inch spike measuring 1 ¾ inches thick that held the wooden cross beam. The wooden cross beam that connected the two metal trucks was 14" x 14" x 24 feet long. On top of the cross beam the rear of the house was attached. The front of the house was balanced on the Fifth Wheel of the 1945 Sterling Heavy Duty Motor Truck with a 14 x 14 inch H beam.

Each of the two trucks were connected to the tractor which pulled the house by four draw bars, two on each truck, that were welded and bolted to the solid 3x3-inch axles. The front wheels of each truck has a vertical 2-inch iron axle that provides steering for the back wheels similar to a fire engine hook and ladder. In 1955 the company pulled a house twenty-five miles from Peabody to Ipswich, MA with the iron wheels by a Sterling six wheel fifteen-speed tractor at night when there was less traffic, and the tar roads were cooler during the nighttime hours. When the house arrived in Ipswich it was then lifted forty feet, one foot at a time, up a 35-degree grade with hand operated jacks.

The last house to be moved by Peter Rubchinuk was in 1990 when a sixty foot by 24- foot house was moved about two miles on the ice of Lake Sunapee, NH in February with a 1948 converted 6x6-wheel drive Ford fire truck.

Cupola Furnace Pouring Floor

The 1890 C.W. Osgood & Son of Bellows Falls, Vermont made heavy paper making machinery with two cupola furnaces and a machine shop.

In the cupola furnace pouring floor there were four cast iron pillars 36 inches high each supporting a 10x10-inch wooden timber 18 feet tall holding the Monitor Roof of the pouring floor.

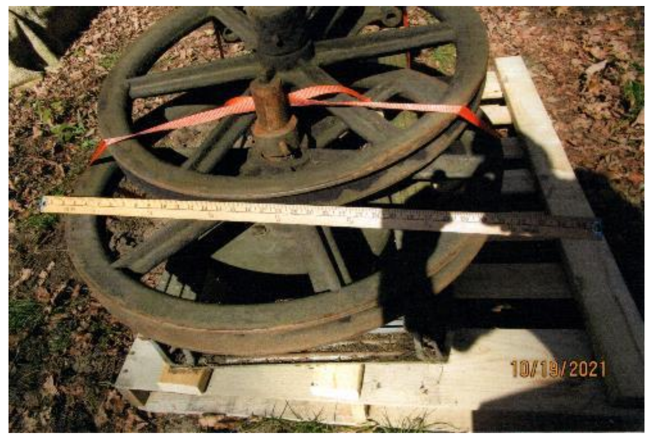
Cast-iron pillars supporting roof pillars

The cast iron pillars are 12x12 inches square and 1 ⅛ inches thick. The bottom has a 2-inch flange that was buried six inches deep in the floor embedded in a concrete base. The top of the pillar has a 1 ½ -inch flange 10 ½ x 10 ½ inches square that the wooden 10 x 10 inch timber fits into. The cast iron pillars were designed to prevent sparks from the molten iron that was being poured into the molds on the floor from burning the timbers.

Two of the pillars were rescued during the demolition by Northern Heritage Mills volunteers.

Steam Driven Incline

The C.W. Osgood & Son foundry of Bellows Falls, Vermont, had an incline that traveled from inside the factory floor to a railroad siding dock seventy-five feet below on a fifty degree grade. The incline pulled a five-foot trolley with a ⅝ inch steel cable around two 30 inch diameter cast iron wheels which traveled to the steam engine located under the floor. The wheels, incline, rails and attachments have been rescued by Adams Construction of Bellows Falls and donated to Northern Heritage Mills during the demolition.



Wire rope wheels from incline

Native American Ceremonial Stone Structure or Cairn (Pre-Contact Period)

Mr. Carl Rubchinuk rigger, heavy machinery operator, teamster and historic heavy machinery mechanic was clearing his densely wooded sloped property in Unity, New Hampshire and uncovered a very large and rare strategically built interlocking stone structure built on top of a flat, almost square 14 foot and 3 foot thick rock. The height of the structure is seven feet and on the top of the conical shape of the structure and on the almost square base is a handmade hole nine inches in diameter and two feet deep which may have supported a wooden Totem Pole. James and Mary Gage [Native American Ceremonial Stone Structure historians] have identified several other stone ceremonial structures with holes or depressions in the center that are thought to be for 'offerings.' Cairns may have originated in the Northeast which have the largest examples of the Native American Ceremonial Structures. Other Native American Cairns can be found with a Goggle search.

A theory is that farmers, when clearing fields piled the rocks is not plausible as the farmers did not have the time to strategically place interlocking rocks on a square base forming a conical design with a hole on top. Most often farmers offloaded sleds or wagons of rocks into piles.

Research of native American ceremonial stone structures in New England has found that there is no mention of this historical site.

Stone cairn, probably built by Native Americans

Stepping Into the Steam Era-The Minne-Ha-Ha Steamboat at Lake George, N.Y.

Rick Ashton

I was visiting Lake George recently with my family and I took advantage of the opportunity to tour the lake on the paddlewheel steamboat Minne-Ha-Ha. The boat is named after a fictional character from Longfellow's "Song of Hiawatha" and today is technically a hybrid ship, moving under steam unless forced by steam failure to rely on an auxiliary propeller driven engine. As the steam was rising from the back of the ship shortly before we left the dock I was transported back into the steam era for a while. The rhythm of the pistons was soothing as we pulled out into the lake. I thought I spotted Samuel Clemens seated nearby but I was brought back to reality by the sound of a modern speedboat flying by.

Before modern methods of transportation took over, rivers were used for the transportation of people and goods. River travel was extremely slow until steamboats entered the picture with their speed of 5 miles per hour! By the early 1800's steamboats were the leading method of transportation in the United States. But it wasn't long before the railroads were competing for that business. In 1830 there were 23 miles of railroad track in the United States. By 1880 there were 93,000 miles of track and in the early 1900's cars, trucks, and airplanes sounded the death knell for the steamboat. The steamboats were dangerous too as boiler explosions, a common problem in the early days of steam, were responsible for many deaths. In the worst nautical disaster in US history, the Sultana paddleboat exploded while returning Union prisoners to the north after the end of the civil war. 1,168 people died that day. Another steamer, the General Slocum caught fire in 1904, killing 958 and injuring 175.

The steamboat I was enjoying is not the original Minne-Ha-Ha, a side-paddle wheeler that could be seen cruising Lake George in the 1800's. In "the book of summer resorts"(1868) it is noted that "If the tourist has only 2 weeks and $100.00, he can make a trip to Sarasota Springs and Lake George." That certainly isn't true today!

The original Minne-Ha-Ha was launched in June of 1857.

Original Minne-Ha-Ha, late1870s
[Note walking beam from original engine]

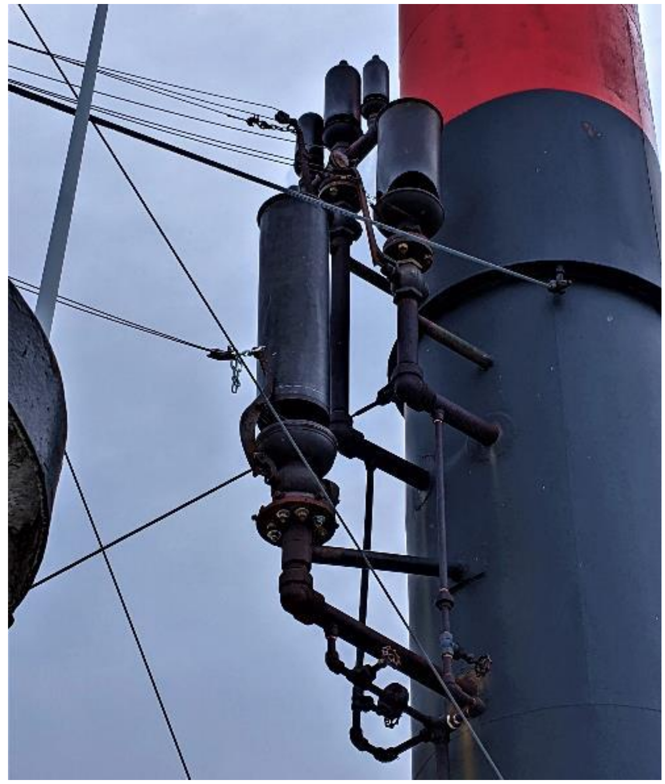
The boat held 400 people and moved through the water at 13 miles per hour. The 140-foot side-wheeler, the last wood burning steamer on the lake burned 6 cords of wood for each 10-hour trip it made The engines and boilers were salvaged from the John Jay, another retired steamer. After the 1876 season, the boat was retired, the engine removed, and the hull was used as a floating hotel. (Images of America-Lake George, Halm & Sharp)

Current Minne-Ha-Ha

The Minne-Ha-Ha at the pier

The current steamboat was built in 1968 at the steamboat company's shipyard in Baldwin NY. Towed to the Steel Pier in Lake George village, the ship was completed there at the cost of $270,000.00. The new boat was 103 feet long, had a 30-foot beam, and a draft of 3.5 feet. Top speed was 7 mph. The 2 main engines are 100 hp, approximately 35rpm. Each contains an 8" piston and a 48" stroke Stephenson reversing valve. In 1998 the ship was renovated. Not being handicapped accessible and difficult to navigate because of low speed, the hull was cut in two and 34 feet of additional hull was installed. An ADA elevator was also installed. A small propeller powered by a Caterpillar diesel engine was added as a backup safety measure in case of a loss of steam. Her twin split stacks were replaced by a single 30-foot-tall stack. Her 3 steam whistles were mounted on the single stack. The boat has 3 operating steam whistles: an 8" Crosby 3 chime, an 8"x50" Lunkenheimer Mockingbird, and a 3 bell Lunkenheimer.

Early steamboats were fueled by wood and coal. The [current] Minne-Ha-Ha runs on diesel fuel. In 2001 the paddlewheel was rebuilt. The boat also features a 1974 calliope built by the Frisbee Engine and Machine Company. The current calliope was installed in 2013. The calliope played "sweet Georgia brown" on the way back to the pier. (Wikipedia)



Three steam whistles on stack

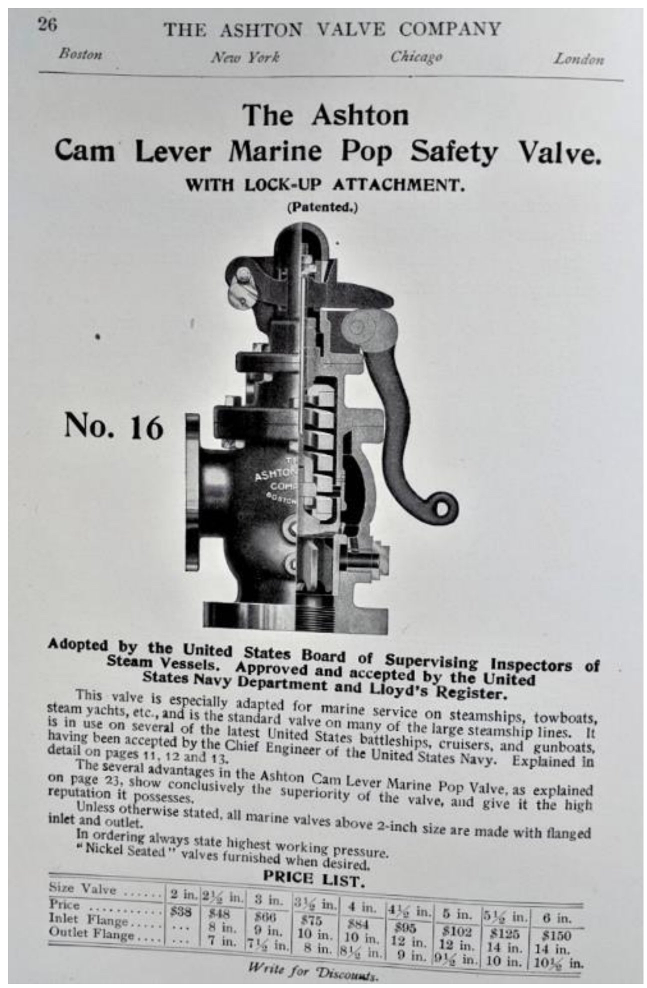
The steam calliope

One of two 100 hp main engines

The Engineer's operator station, directly ahead of the paddlewheel

I have to confess that part of my interest in our steamboat excursion was the hope that I would find Ashton Valve whistles and pressure gages. There are no Ashton Valve products on the boat. In my brief chat with the engineer, I learned that the gages were mainly Crosby and Lunkenheimer. But the Ashton Valve company was very involved in supplying steamboats and marine vessels with safety valves, pressure gages, and steam whistles. In 1872 the company received government approval to supply the Ashton lock up pop safety valve to all government ships. Attached are a couple of Ashton catalog pages featuring the items that would have been found on a typical steamboat.

And so, I stepped off of the Minne-Ha-Ha back into 2021, happy to have seen such a beautiful place in such a great representative of America's age of steam.



26 THE ASHTON VALVE COMPANY

Boston *New York* *Chicago* *London*

The Ashton
Cam Lever Marine Pop Safety Valve.

WITH LOCK-UP ATTACHMENT.

(Patented.)

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Adopted by the United States Board of Supervising Inspectors of Steam Vessels. Approved and accepted by the United States Navy Department and Lloyd's Register.

This valve is especially adapted for marine service on steamships, towboats, steam yachts, etc., and is the standard valve on many of the large steamship lines. It is in use on several of the latest United States battleships, cruisers, and gunboats, having been accepted by the Chief Engineer of the United States Navy. Explained in detail on pages 11, 12 and 13.

The several advantages in the Ashton Cam Lever Marine Pop Valve, as explained on page 23, show conclusively the superiority of the valve, and give it the high reputation it possesses.

Unless otherwise stated, all marine valves above 2-inch size are made with flanged inlet and outlet.

In ordering always state highest working pressure.

"Nickel Seated" valves furnished when desired.

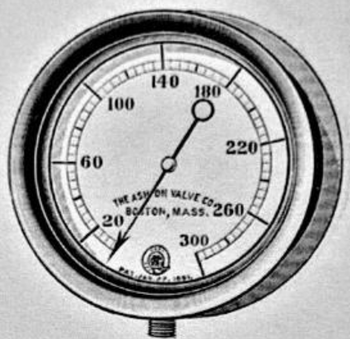
PRICE LIST.

Size Valve	2 in.	2½ in.	3 in.	3½ in.	4 in.	4½ in.	5 in.	5½ in.	6 in.
Price	$38	$48	$66	$75	$84	$95	$102	$125	$150
Inlet Flange	...	8 in.	9 in.	10 in.	10 in.	12 in.	12 in.	14 in.	14 in.
Outlet Flange	...	7 in.	7½ in.	8 in.	8½ in.	9 in.	9½ in.	10 in.	10½ in.

Write for Discounts.

ASHTON

Double Spring Bourdon Pressure Gages.



No. 52.

This gage is specially adapted for locomotive and marine service; it gives least vibration to the hand and is non-freezing.

PRICES, INCLUDING COCK.

Size.	Iron Case, Japanned.	Iron Case. N. P. Ring.	Brass Case.	N. P. Case.
12 inch dial..	$55.00	$56.50	$80.00	$84.00
10 " " ..	37.00	38.00	45.00	48.00
8½ " " ..	25.00	25.75	34.00	36.50
6¾ " " ..	18.00	18.60	22.00	24.00
6 " " ..	15.00	15.50	18.00	19.00
5½ " " ..	12.00	12.25	14.00	15.25
5 " " ..	11.00	11.20	13.00	14.00
4½ " " ..	10.00	10.20	12.00	13.00

WEIGHTS.

Size, inches.	4½	5	5½	6	6¾	8½	10	12
Weight, lbs..	3	3¾	4½	5½	7½	11½	14	25½

In ordering mention style case wanted, and highest working pressure.