

# North Works Station History

An Interactive Qualifying Project Report  
Submitted to the Faculty of the  
WORCESTER POLYTECHNIC INSTITUTE  
in partial fulfillment of the requirements for the  
Degree of Bachelor of Science

Submitted by:

**Dwight Santimore**

**Keith F. Meyer**

Date: April 29<sup>th</sup>, 2010

Approved:

Major Advisor:  
**Professor James Dempsey**

## Keywords

1. North Works
2. Ichabod Washburn
3. Barbed Wire

## **Abstract**

Worcester's Industrial history has its roots in the North Works building located on Grove St. in Worcester. The goal was to collect information on the history of the building and its operations and present it in a web site format. The web site provides a history of the operations and the major people that owned and operated the factory. It gives a full and clear depiction of how the building started to the time of the end of the nineteenth century.

## Table of Contents

Introduction.....	1
Ichabod Washburn 1798-1868.....	1
Benjamin Godard 1791-1867.....	2
Humble Beginnings .....	2
Charles Washburn 1798-1875.....	3
Philip Louis Moen 1824-1891 .....	4
Expansion.....	5
Henry Stevenson Washburn 1831-1903 .....	5
Charles F. Washburn 1827-1893 .....	6
Charles Hill Morgan 1831-1911 .....	7
William E. Rice 1833-1919 .....	8
John W. Gates 1855-1911.....	8
Barbed Wire Boom .....	11
Bibliography .....	15
Appendix A, North Works Timeline .....	17
Appendix B: index.html.....	18
Appendix C: history.html.....	20
Appendix D: people.html.....	30
Appendix E: location.html.....	35
Appendix F: contacts.html.....	40

## **Introduction**

In the second half of the eighteenth century Worcester, MA was the premiere Wire producing city in the world. The North Works factory, located in Worcester, Massachusetts, has been a focal point for much of the city's history. Early in the Industrial Revolution, the North Works Station was one of the only manufacturers of wire in the nation. Over the years it grew and expanded, supporting many of the people of the city. At one point almost twelve percent of Worcester's population benefited from the company's success. In time, the company was able to reach into different markets allowing for more growth generating more prosperity. Through many mergers the building became a part of a nationwide market for the wire business, almost creating a monopoly in its specialty. The massive growth started with very humble beginnings, starting with two gentlemen and increasing its workforce to the thousands.

## **Ichabod Washburn 1798-1868**

Ichabod Washburn, one of the founders of the Worcester Mechanics Association and principle donor of Mechanics Hall, Memorial Hospital and Worcester Polytechnic Institute, was one of the city's first manufacturers when he opened up a ramrod shop in Worcester in 1819. He was often mentioned to have had a desire for improving all things mechanical, always improving upon current designs to make them faster, more efficient and more reliable. At the age of nine, due to financial troubles at home, Ichabod's mother apprenticed him to Abner Harlow who produced carriages, harnesses and trunks out of a shop in Duxbury. In the spring of 1814 he started his apprenticeship as a blacksmith back in Leicester, MA, where he spent two years as an apprentice of Jonathan and David

Trask and another two for Nathan Muzzy, eventually earning the title Journeyman Blacksmith. In the spring of 1819 Ichabod began working at the Millbury Armory where he hammered alongside his first, future business partner Benjamin Godard, and was renowned for his skillful work (Warren 7-8).

## **Benjamin Godard 1791-1867**

Benjamin Godard grew up as a farmer and was a modest, honest man with a pure character. Growing up young Benjamin helped his father, a farmer and tanner, on the homestead as well as nurturing his own mechanical talent. He left the family business in 1812 in an attempt to become successful on his own merits; first he worked on a farm, and afterwards in the Millbury Armory learning to be a machinist. In 1822 he partnered with Ichabod Washburn to create the firm Washburn & Goddard (Warren 9). Together they would form the ground work for one of the largest manufacturing plants in America.

## **Humble Beginnings**

The corporation itself started from humble beginnings. Ichabod Washburn is considered to be the first individual to draw wire in Worcester at a quaint Northville factory. Working together Washburn and Godard started their own factory making woolen machinery and lead pipe. This continued until 1831 when Washburn while developing his own technique for manufacturing wood screws, visited the Read brothers, Clement, Curtis and Henry Read, together forming C. Read & Co., and learned of their developments in manufacturing techniques for wood screws. An arrangement was made and their equipment was sent to the Northville factory. Washburn and Godard would

manufacture the rods for the screws while C. Read & Co. manufactured wood screws from the rods (Washburn 143).

In the year 1831, Ichabod Washburn started to create iron wire. At the time iron wire was not produced in large quantities. On his first eye witness account of a machine that was used to draw wire, he noticed that the machine could only draw out a foot of wire at a time, resetting back to its original position with each pass through (Cheever 46). With this method, Washburn noted that a man could not draw more than fifty pounds of wire a day (Cheever 46). He then decided to improve upon this process by altering the drawing block of the machine. In doing so the machine would pull out fifteen feet of wire each time, thereby increasing the amount produced exponentially. According to Ichabod Washburn, by improving the drawing block, it would increase production to allow for twenty five hundred pounds of iron wire to be produced each day (Cheever 47).

On January 30, 1835 the partnership of Washburn & Godard was dissolved, Godard kept the Northville facility for producing woolen machinery once again, while Godard relocated the rod making machinery to Worcester. Washburn oversaw the construction of a building designed solely for the production of wire (Worcester Magazine 175) on the site of a dammed Mill Brook which created Salisbury Pond.

### **Charles Washburn 1798-1875**

Charles Washburn was Ichabod's twin brother and unlike Ichabod who was apprenticed at an early age, Charles received a formal education and graduated from Brown University in 1820. For the next fifteen years he would study and practice law in Maine. In 1835 he relocated to Worcester, MA and partner with his brother in 1840, only

to leave the joint venture in 1849 to pursue the insurance business. For 1850 and 1851 he would serve as president of the Common Council of Worcester MA and as Director of Washburn & Moen Manufacturing beginning in 1868 until his death on October 27<sup>th</sup> 1875 (Warren 11-12).

For a number of years Washburn's Wire Firm was operated jointly with his brother, but by 1851 Philip Moen, Ichabod Washburn's son in law, was taken on as a partner. It was this partnership that truly allowed the business to flourish.

### **Philip Louis Moen 1824-1891**

Philip L Moen was born in Wilna, New York. He attended multiple schools preparing him to go to Colombia University; however he grew an interest in the hardware trade which would aid in his move to the Washburn & Moen Company. His reason for travelling to Worcester was to marry Ichabod Washburn's daughter, whom he had met at the anniversary of the American Board of Foreign Missions while she attended with Washburn (Crane 55). He possessed a keen eye for business, strict integrity and a winning personality which he extended to all employees, all of which combined to compliment Ichabod's mechanical mastermind beautifully. In 1846 Ichabod made him partner with Henry S. Washburn of the South Works. Philip acted as a foil to Ichabod Washburn's business side, Moen aided in increasing the worth of the manufacturing plant, helping to expand it through various business transactions. He held the office of President of Washburn & Moen Manufacturing Company from 1865 until 1875 when he became Treasurer from 1875 until his death on April 23<sup>rd</sup>, 1891. He was best known for the courtesy he extended to all of his employees without regard to their position in the

company. As a sign of his outstanding relationship with his employees; on the day of his funeral, they lined the street entering the cemetery where he was to be buried and waited for three hours for the exceedingly long funeral service, so they could all serve as a guards of honor for his funeral procession (Warren 14-15).

## **Expansion**

After a slow and steady start to wire production in Worcester, an improved manufacturing technology, increasing product demand, and product diversification would fuel the expansion of wire production operations for the next several decades. Starting in 1847 a new use for wire was developed, the telegraph, and would require new production methods to suit its unique needs. To improve quality wire rod billets were purchased from Sweden and then rolled into a more suitable size in Fall River, Troy and Windsor Locks, Ct. To locate the initial rolling processing closer to the Grove St. plant, the land and water rights of the facility on Lake Quinsigamond were purchased gaining room to grow (Washburn 147). This was Philip Moen's first partnership to be involved with, which was supervised by Henry and Charles Washburn. The partnership at this location dissolved on January 12, 1849, however soon afterwards Philip became a full partner with Ichabod Washburn at the North Works facility.

## **Henry Stevenson Washburn 1831-1903**

Henry Stevenson Washburn began work as a clerk in a bookstore when he was forced to drop out of Brown University for health reasons. In Ichabod Washburn invited Henry to supervise the construction of a mill, which started in 1846, which would later



become known as the South Works. He would eventually retire from his position of partner of the South Works in 1862. Outside of work Henry S. Washburn wore a variety of hats for various organizations including: serving on the Boston School Board for 17 years, Two terms as Representative in the General Court, Two terms as State Senator, Chairman of the Central Committee of the old Whig Party, Director of Worcester Bank from 1852 to 1857, President of Worcester Mechanics Association for four terms, Laying the cornerstone of Mechanics Hall (September 3, 1855). Henry was also a well known poet, most notable for “The Vacant Chair” which became well known by both soldiers in the Northern and Southern armies during the American Civil War (Warren 12-14).

“We shall meet, but we shall miss him.

There will be one vacant chair;

We shall linger to caress him

When we breathe our evening prayer.” – Henry S. Washburn (Warren 14)

### **Charles F. Washburn 1827-1893**

Charles F. Washburn was known to be gentlemanly, genial, conciliatory, an optimist, confident of success, and respectful of all individuals. He was the oldest son of Charles Washburn, Ichabod Washburn’s twin brother. Due to illness he did not attend college but this allowed him to become well traveled and thanks to his ambition for knowledge became a self educated man by reading books upon books. He would become a director and officer of Washburn & Moen Manufacturing Company from its inception until he passed away in 1893. He was elected to the position of Secretary of Washburn

and Moen when it was restructured in 1865 and was known for using his vision and enthusiasm to fuel the company's development efforts and maintain competitiveness. During his life he would become a Member of the Worcester Common Council, the President of the Trustees of the Home for Aged Women, and served on the Board of Trustees of Memorial Hospital (Warren 15-16).

### **Charles Hill Morgan 1831-1911**

Charles H. Morgan founded the Morgan Spring Company and the Morgan Construction Company, which is still family run in Worcester to this day and would one day become an internationally known Mechanical Engineer. Early in his life he worked in the machinist trade, and partook in a memorable series of thirteen evening classes focused on mechanical drafting. Later he would state that these classes, more than anything else, helped to give him his start to his career. Denied a formal technical education Charles raised through the ranks of the Washburn & Moen Manufacturing Company successively from dye-house superintendent, draftsman, designer and inventor, to general superintendent where he stayed from 1864 to 1887. As a result of the denial of a formal technical education, he was a dedicated supporter of the formation of the Worcester County Free Institute of Industrial Science, known today as Worcester Polytechnic Institute. US Senator George F. Hoar name Charles H. Morgan as "one of the most important benefactions ever conferred upon the people of Worcester" (Warren 16-17).

## **William E. Rice 1833-1919**

William E. Rice worked for Ichabod Washburn & Company from 1852 to 1959. His first business venture involved a partnership with Dorrance S. Goddard, son of Benjamin Goddard, and together they created William E. Rice & Company at the site of the south works. This venture failed to last due to a water power shortage and the plant was relocated to Holyoke, MA and a wire mill was constructed on the site. Five years later the Holyoke building was sold to be used as a paper mill and in a deal with Ichabod Washburn the wire drawing equipment was purchased by Ichabod's company and in return Rice would be made a partner in Quinsigamond Iron and Wire Works. He would later be elected treasurer and general manager of Washburn and Moen Manufacturing Company. While with Washburn and Moen, Rice facilitated bringing a Bedson continuous rolling mill to Worcester, which greatly increased production capabilities, once all of the technical issues were worked out. Rice held the position of President of Washburn & Moen Manufacturing Company from 1891 until 1899 when the company was sold to American Steel and Wire of New Jersey in 1899 (Warren 18-19).

## **John W. Gates 1855-1911**

John W. Gates while a native of Du Page County, Illinois, was the driving force of the consolidation of numerous wire manufacturing plants across America into the American Steel & Wire Company. John W. gates was an ambitious, able, and daring on the verge of recklessness individual. Initially he worked as a traveling barbed wire salesman for I. L. Ellwood & Company when the barb wire boom hit, and his success at securing large orders convinced him to become involved in the manufacturing as well as

sale of barbed wire. First, he partnered with J.W. Gates Company and by 1881 Gates became the president of Southern Wire Company. For the next twenty year John W. Gate moved from company to company, merger to merger, always moving on to bigger and better companies and positions. In 1897 Gates was the chief promoter of the American Steel & Wire Company of New Jersey when in 1899 it purchased the Washburn & Moen Manufacturing Company (Warren 22-23).

1850 marked the year that Ichabod Washburn invested into a new the technology of steel wire. It was brought to him by a piano maker, Mr. Chickering, who was interested in the creation of steel wire for his pianos (Cheever 49). Until this time steel wire had only been produced in Webster England for about eighty years prior. Not only was there need for the steel wire created by the music industry, but the textile industry needed it for crinoline, which was being incorporated into the fashion at the time. Crinoline first began production in 1859 and lasted until 1870 when the fashion became less popular. Ichabod Washburn declared that his manufacturing of steel crinoline was the greatest success in his career (Cheever 50). To put into perspective how much of a success manufacturing crinoline was, an order to be processed for the production of skirts called for the Washburn facilities to produce sixty thousand pounds of steel wire, which was over half of what was being produced in the country. Crinoline was produced from cheap cast steel that was continuously tempered and hardened to give it high toughness and elasticity. During the prime of crinoline, consumption reached 1,500 tons annually, the largest single consumption of cast steel in the country for any company at the time (Washburn 151). In Ichabod Washburn's autobiography, he makes a note that three thousand tons of steel wire is required to produce the elegance of a lady's dress.

The reason Washburn's wire was successful was because he patented a method for tempering the steel wire that made its strength large and very durable. The patent called for the wire to be passed along a heated tube until it became red hot (Cheever 50). The heated wire then gets treated through a dip in a cold acid bath to get rid of any impurities. To attest to the strength of the wire, experiments conducted that the wire could withstand weights consisting of at least two thousand pounds without breaking. Ichabod Washburn also developed an improved annealing process early on in his dealings with wire production. His method involved placing the coils of iron to be annealed in double air tight iron pots and then applying the heat of annealing, while this added time to the annealing process, it also gave the iron coils a very even heat treatment and prevented the accelerated oxidation of iron that occurs at elevated temperatures this made his wire a superior product compared to the competition (Washburn 148).

1865 marked the first year of the continuous hardening and tempering process, which allowed for faster and less expensive production of wire. In 1860 Ichabod introduced continuous annealing, cleaning and galvanizing processes, greatly increasing the capacity of production for telegraph wire. By 1863 the demand for cotton coatings for crinoline grew so large that Washburn & Moen constructed their own cotton-mill which fulfilled their needs until 1873 when crinoline production slowed. The fall of 1869 marked a landmark development in wire production when the first continuous mill in America was erected at the Grove St. facilities (Washburn 151). With a now fully continuous

As early as 1867, Washburn & Moen Company was involved in recycling scrap iron into their low grade wire product. Billets measured 1.125" square and 8 to 12 ft in

length, low grade were manufactured at the Quinsigamond facilities. To produce the low grade iron billets scrap iron was sheared into pieces 8” square and stacked 18” tall. The stack was then heated in a furnace until it was of sufficient temperature to weld the pieces of scrap together. Upon removal the stack of heated iron plates was passed through a series of rollers until the profile measured 1.125” square, at which point the ends were trimmed away. A second round of heating was applied; the iron was then rolled to meet No. 4 wire dimensions and coiled into bundles, weighing 20 to 30 lbs each. This method created frequent billets that contain a certain “looseness of structure” (Warren 20) that would fracture during rolling and added to the scrap pile to be used to create another billet (Warren 21). The technology of the day did not allow for the removal of impurities, even today such purification is only possible by recasting metals.

Starting In September 1865 the corporation named Quinsigamond Iron & Wire Works was formed with Philip L. Moen as president, William E Rice as Treasurer and General Manager, and Charles F. Washburn as Secretary. On February 24, 1868 Quinsigamond Iron & Wire Works and Washburn & Moen Wire Works consolidated under a single name, Washburn & Moen Manufacturing Company using a capital of \$1,000,000 which was later raised to \$1,500,000 (Washburn 152).

## **Barbed Wire Boom**

Prior to 1873 wire fencing consisted of single strands of smooth No. 9 wire without any form of spurs and as a result failed often and performed poorly at containing cattle. J.F. Glidden of De Kalb, Illinois first produced barbed wire for use on his own farm in 1873. Making barbed wire by hand was a slow process; three boys and two men

could produce 150 lbs in two days. With the addition of horsepower in June 1874 the production of three boys and two men was increases to 150 pounds a day. By 1889 improvements in manufacturing machinery allowed a single man to produce 2,000pounds, or five and a half miles of barbed wire in just ten hours (Washburn 154-155).

At the request of Charles F. Washburn, a representative of Washburn & Moen Mfg. Co. was dispatched to De Kalb, Illinois to procure control of barbed wire patents. The most prominent patent pertaining to barbed wire was granted to Glidden on November 24, 1874. The patent mentions “the first time a barb made of wire wrapped about a fence wire, and locked in place by a fellow wire twisted with the first” (Washburn 156) which is still produced today. The biggest obstacle preventing barbed wire from taking farms by storm was public opinion and public education. Upon first glance the public had no idea what barbed wire was used for and doubted that it could stop a charging bull. After a few successful and very public demonstrations, special thanks to a particularly ornery bull named “Old Jim” (Washburn 156), the public was quickly swayed and barbed wire soon became one of Washburn & Moen Manufacturing Company’s most popular products. However, with the success of barbed wire spreading, competition also developed and started a long series of wire patent lawsuits concerning barbed wire production and licensing. In December 1880 a US Circuit Court for the Northern District of Illinois ruled in favor of the Washburn & Moen Manufacturing Company and Isaac L. Ellwood, giving them free reign for barbed wire production and licensing to other manufacturers (Washburn 157).

Copper wire production at the Washburn & Moen Manufacturing Company Starting in 1884, and primarily replaced iron wire for telegraph lines and illumination in buildings. The rate at which copper wire production expanded was unprecedented. In 1884 it is estimated that there was just one to two hundred miles of hand crafted copper wire currently in use, and that in just five years time, usage would reach fifty thousand miles, the equivalent of 4,200 tons of metal (Washburn 159).

The 1890's marked the beginning of specialization of production for Worcester wire factories, among some of the specialties were galvanized steel wire cable, wire nails, springs, all sorts of insulated electrical wire, copper bonds for electric railways, and baling wire. (Washburn 161)

On March 11, 1899 the American Steel & Wire Co. purchased Washburn & Moen Mfg. Co. and was later combined with the United States Steel Corporation. With the goal of decreasing travel expenses the common production lines first created in Worcester, were gradually transferred to geographical locations closer to the customer bases as a result the Worcester factories became the specialized plants. In 1906 Barbed wire production ceased in Worcester and moved to the Pennsylvania Works of the Company. "In no other city in the world are so many different kinds of wire and wire products manufactured as are produced in Worcester by the American Steel & Wire Company" (Washburn 165)

The City of Worcester celebrated the 125<sup>th</sup> year anniversary of wire manufacture within the city in 1956. The festivities allowed two days of celebration, one for the workers and their families and another for the citizens of Worcester to tour the factories.



Wire production would continue for another 26 years before shutting ceasing completely, but as the years went by divisions were slowly relocated or shut down. “The failure of the American steel industry to modernize and compete in the new global economy meant a significant loss of manufacturing jobs for Worcester” (Worcester Historical Museum).

## Bibliography

"ABWS." Antique Barbed Wire Society. <<http://www.antiquebarbedwiresociety.com/>>.

"Barb Wire History." Devil's Rope Museum. 2/25/2007 2007.

<<http://www.barbwiremuseum.com/barbedwirehistory.htm>>.

"Brief History of Barbed Wire." Kansas Barbed Wire Museum. 2008.

<<http://www.rushcounty.org/BarbedWireMuseum/BWhistory.htm>>.

Cheever, Henry. Autobiography and Memorials of Ichabod Washburn. Showing How a Great Business Was Developed and Large Wealth Acquired for the Uses of Benevolence. Boston: D. Lothrop and. Boston: D. Lothrop & Company, 1879.

Crane, Ellery B. Historic Homes and Institutions and Genealogical and Personal Memoirs Of Worcester County Massachusetts With a History Of Worcester Society of Antiquity. New York: Lewis Publishing Company, 1907.

Hayter, Earl. "Barbed Wire Fencing - A Prarie Invention." *Agricultural History* 13 (1939) Web.

Krell, Alan. *The Devil's Rope*. London: Reaktion, 2002. Print.

LaPierre, Jeff. "Preserving Worcester's Wire Industry." Bachelor of Science Worcester Polytechnic Institute, 2006. Worcester: Web.

Ricciardi, Dan and Mahoney, Kathryn. "Northworks."  
<<http://college.holycross.edu/projects/worcester/immigration/northworks.htm>>.

"The Papers of Ichabod Washburn." WPI.

<[http://www.wpi.edu/Academics/Library/Archives/EAD\\_Finding\\_Guides/MS26.html](http://www.wpi.edu/Academics/Library/Archives/EAD_Finding_Guides/MS26.html)>.

Ricciardi, Dan and Mahoney, Kathryn. "Northworks."

<<http://college.holycross.edu/projects/worcester/immigration/northworks.htm>>.

Warren, Arthur. Worcester Units of The American Steel & Wire Company.

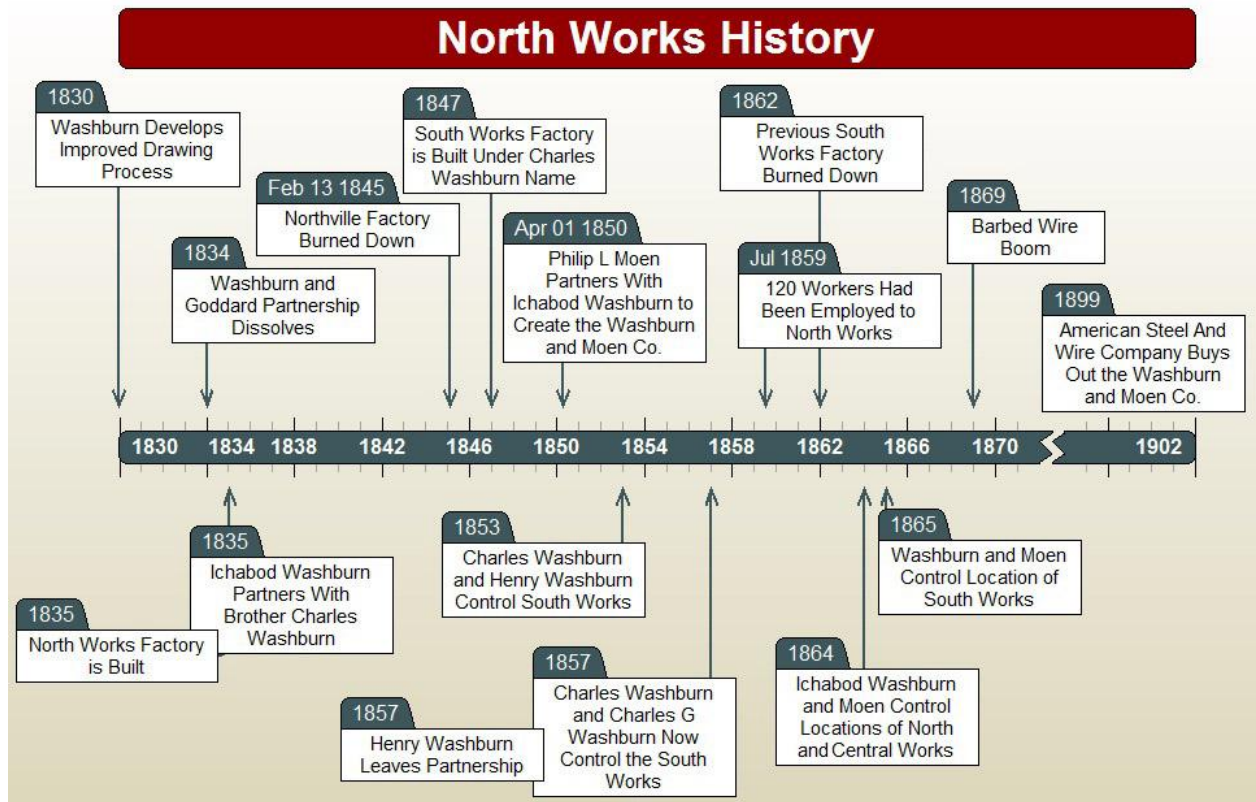
Worcester MA: Industrial Museum of the American Steel & Wire Company, 1929.

Washburn, Charles G. Industrial Worcester. Worcester: The Davis Press, 1917.

Worcester Historical Museum. 16 April 2010

<<http://www.worcesterhistory.org/>>.

## Appendix A, North Works Timeline



## Appendix B: index.html

```
<html>
<head>
<LINK REL="SHORTCUT ICON" HREF="washburn.jpg">
<title>Northworks History</title>
<body bgcolor="#EED6AF" text="#000000">
<link rel="stylesheet" href="menu_style.css">

</head>
<style media="all" type="text/css">@import "/menu/menu_style.css";</style>
<div class="menu">
<ul>
<li><a href="index.html" target="_self" >Home</a>
</li>
<li><a href="history.html" target="_self" >History</a>
<ul>
<li><a href="history.html#beginning" target="_self">A Small Beginning (1830)</a></li>
<li><a href="history.html#middle" target="_self">An Expanding Business (1850)</a></li>
<li><a href="history.html#barb" target="_self">Entering a New Market (1874)</a></li>
<li><a href="history.html#end" target="_self">The Final Merger (1899)</a></li>
</ul>
</li>
<li><a href="people.html" target="_self" >People</a>
<ul>
<li><a href="people.html#ichabod" target="_self">Ichabod Washburn</a></li>
<li><a href="people.html#charles" target="_self">Charles Washburn</a></li>
<li><a href="people.html#henry" target="_self">Henry Washburn</a></li>
<li><a href="people.html#moen" target="_self">Philip L. Moen</a></li>
<li><a href="people.html#rice" target="_self">William Rice</a></li>
<!-- <li><a href="people.html#charlesg" target="_self">Charles F. Washburn</a></li -->
</ul>
</li>
<li><a href="location.html" target="_self" >Locations</a>
</li>
<li><a href="contacts.html" target="_self" >Contacts</a>
</li>
</ul>
</div>

<table width="100%" height="100" bgcolor="maroon" border="0" cellpadding="5" align="left">
  <tr>
    <td colspan="5" border="1" align="center">
      
    </td>
  </tr>
</table>
```

```
</tr>

</table>

<br>
<br>
<br>
<br>
<br>
<br>
<br>
<br>
<br>
<table>
<tr size="12">
<td valign="top">

<!--</td>
<td-->

</td>
</tr>
<tr>
<td>
<font size="2">
The North Works factory, located in Worcester, Massachusetts, has been a focal point for much
of the city's history. Early in the Industrial Revolution, the North Works Station was one of the
only manufacturers of wire in the nation. Over the years it grew and expanded, supporting
many of the people of the city. At one point almost twelve percent of Worcester's population
benefited from the company's success. In time, the company was able to reach into different
markets allowing for more growth generating more prosperity. Through many mergers the
building became apart of a nationwide marketer for the wire business, almost creating a
monopoly in its specialty. The massive growth started with very humble beginnings, starting
with two gentlemen and increasing its workforce to the thousands.
</font>
</td>
</tr>
</table>

</body>
</html>
```

## Appendix C: history.html

```
<html>
<head>
<LINK REL="SHORTCUT ICON" HREF="washburn.jpg">
<title>Northworks History</title>
<body bgcolor="#EED6AF" text="#000000">
<link rel="stylesheet" href="menu_style.css">

</head>

<style media="all" type="text/css">@import "/menu/menu_style.css";</style>
<div class="menu">
<ul>
<li><a href="index.html" target="_self" >Home</a>
</li>
<li><a href="history.html" target="_self" >History</a>
<ul>
<li><a href="history.html#beginning" target="_self">A Small Beginning (1830)</a></li>
<li><a href="history.html#middle" target="_self">An Expanding Business (1850)</a></li>
<li><a href="history.html#barb" target="_self">Entering a New Market (1874)</a></li>
<li><a href="history.html#end" target="_self">The Final Merger (1899)</a></li>
</ul>
</li>
<li><a href="people.html" target="_self" >People</a>
<ul>
<li><a href="people.html#ichabod" target="_self">Ichabod Washburn</a></li>
<li><a href="people.html#charles" target="_self">Charles Washburn</a></li>
<li><a href="people.html#henry" target="_self">Henry Washburn</a></li>
<li><a href="people.html#moen" target="_self">Philip L. Moen</a></li>
<li><a href="people.html#rice" target="_self">William Rice</a></li>
<!-- <li><a href="people.html#charlesg" target="_self">Charles F. Washburn</a></li> -->
</ul>
</li>
<li><a href="location.html" target="_self" >Locations</a>
</li>
<li><a href="contacts.html" target="_self" >Contacts</a>
</li>
</ul>
</div>

<table width="100%" height="100" bgcolor="maroon" border="0" cellpadding="5" align="left">
  <tr>
    <td colspan="5" border="1" align="center">
      
    </td>
  </tr>
</table>
```

</tr>

</table>

<br>

<br>

<br>

<br>

<br>

<br>

<br>

<br>

<br>

<center>



</center>

<br>

<br>

<a name="beginning">

<table>

<tr>

<td>

<font size="6"><b>A Small Beginning (1830)</b></font>

</td>

</tr>

<tr>

<td>

Ichabod Washburn first partnered with William H. Howard in 1819 to build machinery for manufacturing woolen

textiles and lead pipe only to buy out William's share one year later. By 1822, due to rising demand for woolen

machinery, Washburn partnered with Benjamin Godard to create the firm Washburn & Goddard.

Benjamin Goddard was born on May 5th 1791 in Royalston, MA. Growing up young Benjamin helped his father who was a

farmer and tanner as well as nurturing his own mechanical talent. He left the family homestead in 1812 in an

attempt to become successful independently of his family; first he worked on a farm, and afterwards in the Millbury

Armory learning to be a machinist. In 1822 he partners with Ichabod Washburn to create the firm Washburn &

Goddard.



<br>

<p>

In the year 1831, Ichabod Washburn started to create iron wire. At the time iron wire was not produced in

large quantities. On his first eye witness account of a machine that was used to draw wire, he noticed that the

machine could only draw out a foot of wire at a time, resetting back to its original position with each pass

through. With this method, Washburn noted that a man could not draw more than fifty pounds of wire a day. He

then decided to improve upon this process by altering the drawing block of the machine. In doing so the machine

would pull out fifteen feet of wire each time, thereby increasing the amount produced exponentially. According to

Ichabod Washburn, by improving the drawing block, it would increase production to allow for twenty five hundred

pounds of iron wire to be produced each day. However this would not be Washburn's most successful innovation

<br>

<p>

By 1834, Washburn moved the machines to the Grove Street facility, what would soon be called the North

Works factory. It was created and funded by Stephen Salisbury, a businessman and entrepreneur in the Worcester

area. Most of the machinery and production in the factory was engineered by Ichabod Washburn in some way. In his

employ was about twenty five workmen to control all of the machines. Having now left the Northville factory, and

created a solid foundation in the new area, Washburn and Goddard dissolved their partnership, leaving Goddard with

the Northville factory, which would burn down in 1845.

</td>

</tr>

</table>

<a name="middle">

<table>  
<tr>  
<td>  
<font size="6"><b>Expanding The Business (1850)</b></font>  
</td>  
</tr>

<tr>  
<td>  
After a slow and steady start to wire production in Worcester, an improved manufacturing technology, increasing

product demand, and product diversification would fuel the expansion of wire production operations for the next

several decades. Starting in 1847 a new use for wire was developed, the telegraph, and would require new

production methods to suit its unique needs. To improve quality wire rod billets were purchased from Sweden and

then rolled into a more suitable size in Fall River, Troy and Windsor Locks, Ct. To locate the initial rolling

processing closer to the Grove St. plant, the land and water rights of the facility on Lake Quinsigamond were

purchased gaining room to grow (Washburn 147). This was Philip Moen's first partnership to be involved with, which

was supervised by Henry and Charles Washburn. The partnership at this location dissolved on January 12, 1849,

however soon afterwards Philip became a full partner with Ichabod Washburn at the North Works facility.

<br>

<p> 1850 marked the year that Ichabod Washburn invested into a new the technology of steel wire. It was

brought to him by a piano maker, Mr. Chickering, who was interested in the creation of steel wire for his pianos

(Cheever 49). Until this time steel wire had only been produced in Webster England for about eighty years prior.

Not only was there need for the steel wire created by the music industry, but the textile industry needed it for

crinoline, which was being incorporated into the fashion at the time. Crinoline first began production in 1859 and

lasted until 1870 when the fashion became less popular. Ichabod Washburn declared that his manufacturing of steel

crinoline was the greatest success in his career (Cheever 50). To put into perspective how much of a success

manufacturing crinoline was, an order to be processed for the production of skirts called for the Washburn

facilities to produce sixty thousand pounds of steel wire, which was over half of what was being produced in the

country. Crinoline was produced from cheap cast steel that was continuously tempered and hardened to give it high

toughness and elasticity. During the prime of crinoline, consumption reached 1,500 tons annually, the largest

single consumption of cast steel in the country for any company at the time (Washburn 151). In Ichabod Washburn's

autobiography, he makes a note that three thousand tons of steel wire is required to produce the elegance of a

lady's dress.

<br>

<p>The reason Washburn's wire was successful was because he patented a method for tempering the steel wire that

made its strength large and very durable. The patent called for the wire to be passed along a heated tube until it

became red hot (Cheever 50). The heated wire then gets treated through a dip in a cold acid bath to get rid of any

impurities. To attest to the strength of the wire, experiments conducted that the wire could withstand weights

consisting of at least two thousand pounds without breaking. Ichabod Washburn also developed an improved annealing

process early on in his dealings with wire production. His method involved placing the coils of iron to be annealed

in double air tight iron pots and then applying the heat of annealing, while this added time to the annealing

process, it also gave the iron coils a very even heat treatment and prevented the accelerated oxidation of iron

that occurs at elevated temperatures this made his wire a superior product compared to the competition (Washburn

148).

<br>

<p> 1865 marked the first year of the continuous hardening and tempering process, which allowed for faster and

less expensive production of wire. In 1860 Ichabod introduced continuous annealing, cleaning and galvanizing

processes, greatly increasing the capacity of production for telegraph wire. By 1863 the demand for cotton

coatings for crinoline grew so large that Washburn & Moen constructed their own cotton-mill which fulfilled their

needs until 1873 when crinoline production slowed. The fall of 1869 marked a landmark development in wire

production when the first continuous mill in America was erected at the Grove St. facilities (Washburn 151). With a

now fully continuous

<br>

<p> As early as 1867, Washburn & Moen Company was involved in recycling scrap iron into their low grade wire

product. Billets measured 1.125" square and 8 to 12 ft in length, low grade were manufactured at the Quinsigamond

facilities. To produce the low grade iron billets scrap iron was sheared into pieces 8" square and stacked 18"

tall. The stack was then heated in a furnace until it was of sufficient temperature to weld the pieces of scrap

together. Upon removal the stack of heated iron plates was passed through a series of rollers until the profile

measured 1.125" square, at which point the ends were trimmed away. A second round of heating was applied; the iron

was then rolled to meet No. 4 wire dimensions and coiled into bundles, weighing 20 to 30 lbs each. This method

created frequent billets that contain a certain "looseness of structure" (Warren 20) that would fracture during

rolling and added to the scrap pile to be used to create another billet (Warren 21). The technology of the day did

not allow for the removal of impurities, even today such purification is only possible by recasting metals.

Starting In September 1865 the corporation named Quinsigamond Iron & Wire Works was formed with Philip L. Moen as

president, William E Rice as Treasurer and General Manager, and Charles F. Washburn as Secretary. On February 24,

1868 Quinsigamond Iron & Wire Works and Washburn & Moen Wire Works consolidated under a single name, Washburn &

Moen Manufacturing Company using a capital of \$1,000,000 which was later raised to \$1,500,000 (Washburn 152).

</td>  
</tr>  
</table>

<a name="barb">  
<table>  
<tr>  
<td>  
<font size="6"><b>A New Market (1874)</b></font>  
</td>  
</tr>  
<tr>  
<td>

Prior to 1873 wire fencing consisted of single strands of smooth No. 9 wire without any form of spurs and as a

result failed often and performed poorly at containing cattle. J.F. Glidden of De Kalb, Illinois first produced

barbed wire for use on his own farm in 1873. Making barbed wire by hand was a slow process; three boys and two men

could produce 150 lbs in two days. With the addition of horsepower in June 1874 the production of three boys and

two men was increases to 150 pounds a day. By 1889 improvements in manufacturing machinery allowed a single man to

produce 2,000pounds, or five and a half miles of barbed wire in just ten hours (Washburn 154-155).

At the request of Charles F. Washburn, a representative of Washburn & Moen Mfg. Co. was dispatched to De Kalb,

Illinois to procure control of barbed wire patents. The most prominent patent pertaining to barbed wire was

granted to Glidden on November 24, 1874. The patent mentions “the first time a barb made of wire wrapped about a

fence wire, and locked in place by a fellow wire twisted with the first” (Washburn 156) which is still produced

today. The biggest obstacle preventing barbed wire from taking farms by storm was public opinion and public

education. Upon first glance the public had no idea what barbed wire was used for and doubted that it could stop a

charging bull. After a few successful and very public demonstrations, special thanks to a particularly ornery bull

named “Old Jim” (Washburn 156), the public was quickly swayed and barbed wire soon became one of Washburn & Moen

Manufacturing Company’s most popular products. However, with the success of barbed wire spreading, competition

also developed and started a long series of wire patent lawsuits concerning barbed wire production and licensing.

In December 1880 a US Circuit Court for the Northern District of Illinois ruled in favor of the Washburn & Moen

Manufacturing Company and Isaac L. Ellwood, giving them free reign for barbed wire production and licensing to

other manufacturers (Washburn 157).

</td>  
</tr>  
</table>  
<a name="end">  
<table>  
<tr>  
<td>  
<font size="6"><b>A Final Merger (1899)</b></font>  
</td>  
</tr>  
<tr>  
<td>

Copper wire production at the Washburn & Moen Manufacturing Company Starting in 1884, and primarily replaced iron

wire for telegraph lines and illumination in buildings. The rate at which copper wire production expanded was

unprecedented. In 1884 it is estimated that there was just one to two hundred miles of hand crafted copper wire

currently in use, and that in just five years time, usage would reach fifty thousand miles, the equivalent of 4,200

tons of metal (Washburn 159).

<br>  
<p>

The 1890's marked the beginning of specialization of production for Worcester wire factories, among some of the

specialties were galvanized steel wire cable, wire nails, springs, all sorts of insulated electrical wire, copper

bonds for electric railways, and baling wire. (Washburn 161)

<br>  
<p>

On March 11, 1899 the American Steel & Wire Co. purchased Washburn & Moen Mfg. Co. and was later combined with the

United States Steel Corporation. With the goal of decreasing travel expenses the common production lines first

created in Worcester, were gradually transferred to geographical locations closer to the customer bases as a result

the Worcester factories became the specialized plants. In 1906 Barbed wire production ceased in Worcester and

moved to the Pennsylvania Works of the Company. “In no other city in the world are so many different kinds of wire

and wire products manufactured as are produced in Worcester by the American Steel & Wire Company” (Washburn 165)

The City of Worcester celebrated the 125th year anniversary of wire manufacture within the city in 1956. The

festivities allowed two days of celebration, one for the workers and their families and another for the citizens of

Worcester to tour the factories. Wire production would continue for another 26 years before shutting ceasing

completely, but as the years went by divisions were slowly relocated or shut down. “The failure of the American

steel industry to modernize and compete in the new global economy meant a significant loss of manufacturing jobs

for Worcester” (Worcester Historical Museum)

</td>  
</tr>  
</table>

</body>  
</html>



## Appendix D: people.html

```
<html>
<head>
<LINK REL="SHORTCUT ICON" HREF="washburn.jpg">
<title>Northworks History</title>
<body bgcolor="#EED6AF" text="#000000">
<link rel="stylesheet" href="menu_style.css">

</head>

<style media="all" type="text/css">@import "/menu/menu_style.css";</style>
<div class="menu">
<ul>
<li><a href="index.html" target="_self" >Home</a>
</li>
<li><a href="history.html" target="_self" >History</a>
<ul>
<li><a href="history.html#beginning" target="_self">A Small Beginning (1830)</a></li>
<li><a href="history.html#middle" target="_self">An Expanding Business (1850)</a></li>
<li><a href="history.html#barb" target="_self">Entering a New Market (1874)</a></li>
<li><a href="history.html#end" target="_self">The Final Merger (1899)</a></li>
</ul>
</li>
<li><a href="people.html" target="_self" >People</a>
<ul>
<li><a href="people.html#ichabod" target="_self">Ichabod Washburn</a></li>
<li><a href="people.html#charles" target="_self">Charles Washburn</a></li>
<li><a href="people.html#henry" target="_self">Henry Washburn</a></li>
<li><a href="people.html#moen" target="_self">Philip L. Moen</a></li>
<li><a href="people.html#rice" target="_self">William Rice</a></li>
<li><a href="people.html#charlesg" target="_self">Charles F. Washburn</a></li>
</ul>
</li>
<li><a href="location.html" target="_self" >Locations</a>
</li>
<li><a href="contacts.html" target="_self" >Contacts</a>
</li>
</ul>
</div>

<table width="100%" height="100" bgcolor="maroon" border="0" cellpadding="5" align="left">
  <tr>
    <td colspan="5" border="1" align="center">
      
    </td>
  </tr>
</table>
```

</tr>

</table>

<br><br><br><br><br><br><br><br>

<a name="ichabod">

<table class="personleft">

<tr>

<td width="180">



</td>

<td rowspan="2" valign="top" text="2">

Ichabod Washburn, one of the founders of the Worcester Mechanics Association and principle donor of Mechanics Hall, Memorial Hospital and Worcester Polytechnic Institute, was one of the city's first manufacturers when he opened up a ramrod shop in Worcester in 1819. He was often mentioned to have had a desire for improving all things mechanical, always improving upon current designs to make them faster, more efficient and more reliable. At the age of nine, due to financial troubles at home, Ichabod's mother apprenticed him to Abner Harlow who produced carriages, harnesses and trunks out of a shop in Duxbury. In the spring of 1814 he started his apprenticeship as a blacksmith back in Leicester, MA, where he spent two years as an apprentice of Jonathan and David Trask and another two for Nathan Muzzy, eventually earning the title Journeyman Blacksmith. In the spring of 1819 Ichabod began working at the Millbury Armory where he hammered alongside his first, future business partner Benjamin Godard, and was renowned for his skillful work (Warren 7-8).

</td>

<tr>

<td align="center">

Ichabod Washburn

</td>

</tr>

</table>

<br><br>

<a name="moen">

<table class="personright">

<tr>

<td rowspan="2" valign="top">

Philip L Moen was born in Wilna, New York. He attended multiple schools preparing him to go to Columbia University; however he grew an interest in the hardware trade which would aid in his move to the Washburn & Moen Company. His reason for travelling to Worcester was to marry Ichabod Washburn's daughter, whom he had met at the anniversary of the American Board of Foreign Missions while she attended with Washburn (Crane 55). He possessed a keen eye for business, strict integrity and a winning personality which he extended to all employees, all of which combined to compliment Ichabod's mechanical mastermind beautifully. In 1846 Ichabod made him partner with Henry S. Washburn of the South Works. Philip acted as a foil to Ichabod Washburn's business side, Moen aided in increasing the worth

of the manufacturing plant, helping to expand it through various business transactions. He held the office of President of Washburn & Moen Manufacturing Company from 1865 until 1875 when he became Treasurer from 1875 until his death on April 23rd, 1891. He was best known for the courtesy he extended to all of his employees without regard to their position in the company. As a sign of his outstanding relationship with his employees; on the day of his funeral, they lined the street entering the cemetery where he was to be buried and waited for three hours for the exceedingly long funeral service, so they could all serve as a guards of honor for his funeral procession (Warren 14-15).

```

        </td>
        <td width="180">
        
        </td>
    <tr>
        <td align="center">
        Philip Moen
        </td>
    </tr>
</table>

```

<br><br>

```

<a name="charles">
<table class="personleft">
    <tr>

```

```

        <td width="180">
        
        </td>
        <td rowspan="2" valign="top">

```

Charles Washburn was the twin brother of Ichabod Washburn. They both had very similar upbringings. In 1820, Charles graduated from Brown University. His first venture was opening a law office in Harrison, maine. the experience there lead him to become part of the Maine state legislature in 1830. However after an enticing offer from his brother, Charles Washburn moved to Worcester in 1835. By 1840 he was employed by his Ichabod at the Washburn and Moen Co. and soon would control the South Works factory with cousin Henry S. Washburn. His final position in the company was as director from 1868 to 1875.

```

    <tr>
        <td align="center">
        Charles Washburn
        </td>
    </tr>
</table>

```

<br><br>

```

<a name="henry">
<table class="personright">
    <tr>

```

```

        <td rowspan="2" valign="top">

```

Henry Washburn was cousin to Ichabod and Charles. His original job was working as a clerk in a bookstore. While Ichabod was building his wire factories, Ichabod would

contact Henry in order for him to go to the local auction houses in Boston to supply him with wire rods. He would eventually retire from his position of partner of the South Works in 1862. Outside of work Henry S. Washburn wore a variety of hats for various organizations including: serving on the Boston School Board for 17 years, Two terms as Representative in the General Court, Two terms as State Senator, Chairman of the Central Committee of the old Whig Party, Director of Worcester Bank from 1852 to 1857, President of Worcester Mechanics Association for four terms, Laying the cornerstone of Mechanics Hall (September 3, 1855). Henry was also a well known poet, most notable for "The Vacant Chair" which became well known by both soldiers in the Northern and Southern armies during the American Civil War (Warren 12-14).

```

        </td>
        <td width="180">
        
        </td>
    </tr>
    <tr>
        <td align="center">
        Henry Washburn
        </td>
    </tr>
</table>

```

```

<br><br>
<a name="rice">
<table class="personright">
    <tr>

```

```

        <td width="180">
        
        </td>
        <td rowspan="2" valign="top">
        William E. Rice worked for Ichabod Washburn & Company from 1852 to 1959.
        His first business venture involved a partnership with Dorrance S. Goddard, son of Benjamin
        Goddard, and together they created William E. Rice & Company at the site of the south works.
        This venture failed to last due to a water power shortage and the plant was relocated to
        Holyoke, MA and a wire mill was constructed on the site. Five years later the Holyoke building
        was sold to be used as a paper mill and in a deal with Ichabod Washburn the wire drawing
        equipment was purchased by Ichabod's company and in return Rice would be made a partner in
        Quinsigamond Iron and Wire Works. He would later be elected treasurer and general manager
        of Washburn and Moen Manufacturing Company. While with Washburn and Moen, Rice
        facilitated bringing a Bedson continuous rolling mill to Worcester, which greatly increased
        production capabilities, once all of the technical issues were worked out. Rice held the position
        of President of Washburn & Moen Manufacturing Company from 1891 until 1899 when the
        company was sold to American Steel and Wire of New Jersey in 1899 (Warren 18-19).
    </td>

```

```

    </tr>
    <tr>
        <td align="center">
        William Rice
        </td>
    </tr>

```

```
</table>
<br><br>
<a name="charlesg">
<table class="personright">
  <tr>
    <td rowspan="2" valign="top">
      Charles F. Washburn was known to be gentlemanly, genial, conciliatory, an
      optimist, confident of success, and respectful of all individuals. He was the oldest son of Charles
      Washburn, Ichabod Washburn's twin brother. Due to illness he did not attend college but this
      allowed him to become well traveled and thanks to his ambition for knowledge became a self
      educated man by reading books upon books. He would become a director and officer of
      Washburn & Moen Manufacturing Company from its inception until he passed away in 1893. He
      was elected to the position of Secretary of Washburn and Moen when it was restructured in
      1865 and was known for using his vision and enthusiasm to fuel the company's development
      efforts and maintain competitiveness. During his life he would become a Member of the
      Worcester Common Council, the President of the Trustees of the Home for Aged Women, and
      served on the Board of Trustees of Memorial Hospital (Warren 15-16).
    </td>
    <td width="180">
      
    </td>
  <tr>
    <td align="center">
      Charles F. Washburn
    </td>
  </tr>
</table>
<br><br>

</body>
</html>
```

## Appendix E: location.html

```
<html>
<head>
<LINK REL="SHORTCUT ICON" HREF="washburn.jpg">
<title>Northworks History</title>
<body bgcolor="#EED6AF" text="#000000">
<link rel="stylesheet" href="menu_style.css">

</head>

<style media="all" type="text/css">@import "/menu/menu_style.css";</style>
<div class="menu">
<ul>
<li><a href="index.html" target="_self" >Home</a>
</li>
<li><a href="history.html" target="_self" >History</a>
<ul>
<li><a href="history.html#beginning" target="_self">A Small Beginning (1830)</a></li>
<li><a href="history.html#middle" target="_self">An Expanding Business (1850)</a></li>
<li><a href="history.html#barb" target="_self">Entering a New Market (1874)</a></li>
<li><a href="history.html#end" target="_self">The Final Merger (1899)</a></li>
</ul>
</li>
<li><a href="people.html" target="_self" >People</a>
<ul>
<li><a href="people.html#ichabod" target="_self">Ichabod Washburn</a></li>
<li><a href="people.html#charles" target="_self">Charles Washburn</a></li>
<li><a href="people.html#henry" target="_self">Henry Washburn</a></li>
<li><a href="people.html#moen" target="_self">Philip L. Moen</a></li>
<li><a href="people.html#rice" target="_self">William Rice</a></li>
<!-- <li><a href="people.html#charlesg" target="_self">Charles F. Washburn</a></li> -->
</ul>
</li>
<li><a href="location.html" target="_self" >Locations</a>
</li>
<li><a href="contacts.html" target="_self" >Contacts</a>
</li>
</ul>
</div>

<table width="100%" height="100" bgcolor="maroon" border="0" cellpadding="5" align="left">
  <tr>
    <td colspan="5" border="1" align="center">
      
    </td>
  </tr>
</table>
```

```

        </tr>
</table>

<br>
<br>
<br>
<br>
<table width="100%" border="1" >
  <tr>
    <td width="10%">
      </td>
    <td width="30%">
      
    </td>
    <td width="30%">
      
    </td>
    <td width="30%">
      
    </td>
  </tr>
  <tr>
    <td width="10%">
      <b>Name:</b>
    </td>
    <td width="30%" align="center">
      <b>North Works</b>
    </td>
    <td width="30%" align="center">
      <b>South Works</b>
    </td>
    <td width="30%" align="center">
      <b>Central Works</b>
    </td>
  </tr>
  <tr>
    <td width="10%">
      <b>Located:</b>
    </td>
    <td width="30%" align="center">
      Grove St. Worcester, MA
    </td>
    <td width="30%" align="center">
      Lake Quinsigamond Worcester, MA
    </td>
    <td width="30%" align="center">
      Cambridge St. Worceseter, MA

```

```

        </td>
</tr>
<tr>
    <td width="10%">
        <b>1831</b>
    </td>
    <td width="30%" align="center">
        Factory Built; Owned by Ichabod Washburn
    </td>
    <td width="30%" align="center">
        &nbsp;
    </td>
    <td width="30%" align="center">
        &nbsp;
    </td>
</tr>
<tr>
    <td width="10%">
        <b>1840</b>
    </td>
    <td width="30%" align="center">
        &nbsp;
    </td>
    <td width="30%" align="center">
        &nbsp;
    </td>
    <td width="30%" align="center">
        Property Owned by Ichabod Washburn
    </td>
</tr>
<tr>
    <td width="10%">
        <b>1847</b>
    </td>
    <td width="30%" align="center">
        &nbsp;
    </td>
    <td width="30%" align="center">
        Factory Built; Owned by Washburn, Moen & Co.
    </td>
    <td width="30%" align="center">
        &nbsp;
    </td>
</tr>
<tr>
    <td width="10%">
        <b>1850</b>
    </td>

```



```

        <td width="30%" align="center">
        Owned by Washburn & Moen Co.
        </td>
        <td width="30%" align="center">
        Owned by Henry S. Washburn & Co.
        </td>
        <td width="30%" align="center">
        &nbsp;
        </td>
</tr>
<tr>
        <td width="10%">
        <b>1857</b>
        </td>
        <td width="30%" align="center">
        &nbsp;
        </td>
        <td width="30%" align="center">
        Owned by C.Washburn & Son
        </td>
        <td width="30%" align="center">
        &nbsp;
        </td>
</tr>
<tr>
        <td width="10%">
        <b>1865</b>
        </td>
        <td width="30%" align="center">
        &nbsp;
        </td>
        <td width="30%" align="center">
        &nbsp;
        </td>
        <td width="30%" align="center">
        Supervised by William E. Rice
        </td>
</tr>
<tr>
        <td width="10%">
        <b>1868</b>
        </td>
        <td width="30%" align="center">
        &nbsp;
        </td>
        <td width="30%" align="center">
        Owned by Washburn & moen Co.
        </td>

```

```
<td width="30%" align="center">
  &nbsp;
</td>
</tr>
<tr>
  <td width="10%">
    <b>1899</b>
  </td>
  <td width="30%" align="center">
    Owned By American Steel and Wire Company
  </td>
  <td width="30%" align="center">
    Owned By American Steel and Wire Company
  </td>
  <td width="30%" align="center">
    Owned By American Steel and Wire Company
  </td>
</tr>
</table>
</body>
</html>
```

## Appendix F: contacts.html

```
<html>
<head>
<LINK REL="SHORTCUT ICON" HREF="washburn.jpg">
<title>Northworks History</title>
<body bgcolor="#EED6AF" text="#000000">
<link rel="stylesheet" href="menu_style.css">

</head>

<style media="all" type="text/css">@import "/menu/menu_style.css";</style>
<div class="menu">
<ul>
<li><a href="index.html" target="_self" >Home</a>
</li>
<li><a href="history.html" target="_self" >History</a>
<ul>
<li><a href="history.html#beginning" target="_self">A Small Beginning (1830)</a></li>
<li><a href="history.html#middle" target="_self">An Expanding Business (1850)</a></li>
<li><a href="history.html#barb" target="_self">Entering a New Market (1874)</a></li>
<li><a href="history.html#end" target="_self">The Final Merger (1899)</a></li>
</ul>
</li>
<li><a href="people.html" target="_self" >People</a>
<ul>
<li><a href="people.html#ichabod" target="_self">Ichabod Washburn</a></li>
<li><a href="people.html#charles" target="_self">Charles Washburn</a></li>
<li><a href="people.html#henry" target="_self">Henry Washburn</a></li>
<li><a href="people.html#moen" target="_self">Philip L. Moen</a></li>
<li><a href="people.html#rice" target="_self">William Rice</a></li>
<li><a href="people.html#charlesg" target="_self">Charles F. Washburn</a></li>
</ul>
</li>
<li><a href="location.html" target="_self" >Locations</a>
</li>
<li><a href="contacts.html" target="_self" >Contacts</a>
</li>
</ul>
</div>

<table width="100%" height="100" bgcolor="maroon" border="0" cellpadding="5" align="left">
  <tr>
    <td colspan="5" border="1" align="center">
      
    </td>
  </tr>
</table>
```

</tr>

</table>

<br><br>

<font size="12"><b><center>Works Cited</center></b></font><br><p>

"ABWS." Antique Barbed Wire Society. <a href="http://www.antiquebarbedwiresociety.com/">http://www.antiquebarbedwiresociety.com/</a>. <br><p>

"Barb Wire History." Devil's Rope Museum. 2/25/2007 2007. <a

href="http://www.barbwiremuseum.com/barbedwirehistory.htm">http://www.barbwiremuseum.com/barbedwirehistory.htm</a>.

<br><p>

"Brief History of Barbed Wire." Kansas Barbed Wire Museum. 2008. <a

href="http://www.rushcounty.org/BarbedWireMuseum/BWHistory.htm">http://www.rushcounty.org/BarbedWireMuseum/BWHistor

y.htm</a>. <br><p>

Cheever, Henry. Autobiography and Memorials of Ichabod Washburn. Showing How a Great Business Was Developed and

Large Wealth Acquired for the Uses of Benevolence. Boston: D. Lothrop and. Boston: D. Lothrop & Company,

1879.<br><p>

Crane, Ellery B. Historic Homes and Institutions and Genealogical and Personal Memoirs Of Worcester County

Massachusetts With a History Of Worcester Society of Antiquity. New York: Lewis Publishing Company, 1907.<br><p>

Hayter, Earl. "Barbed Wire Fencing - A Prairie Invention." Agricultural History 13 (1939) Web.<br><p>

Krell, Alan. The Devil's Rope. London: Reaktion, 2002. Print.<br><p>

LaPierre, Jeff. "Preserving Worcester's Wire Industry." Bachelor of Science Worcester Polytechnic Institute, 2006.

Worcester: Web. <br><p>

Ricciardi, Dan and Mahoney, Kathryn. "Northworks." <a

href="http://college.holycross.edu/projects/worcester/immigration/northworks.htm">http://college.holycross.edu/proj

ects/worcester/immigration/northworks.htm</a>. <br><p>

"The Papers of Ichabod Washburn." WPI. <a

href="http://www.wpi.edu/Academics/Library/Archives/EAD\_Finding\_Guides/MS26.html">http://www.wpi.edu/Academics/Libr

ary/Archives/EAD\_Finding\_Guides/MS26.html</a>. <br><p>  
Ricciardi, Dan and Mahoney, Kathryn. "Northworks." <a

href="http://college.holycross.edu/projects/worcester/immigration/northworks.htm">http://college.holycross.edu/proj

ects/worcester/immigration/northworks.htm</a>. <br><p>

Warren, Arthur. Worcester Units of The American Steel & Wire Company. Worcester MA: Industrial Museum of the

American Steel & Wire Company, 1929.<br><p>

Washburn, Charles G. Industrial Worcester. Worcester: The Davis Press, 1917.

Worcester Historical Museum. 16 April 2010 <a

href="http://www.worcesterhistory.org/">http://www.worcesterhistory.org/</a>.<br>

<br><br>

<font size="12"><b><center>Contact Info</center></b></font>

<table class="personleft">

<tr>

<td width="180">



</td>

<td rowspan="2" valign="top">

<br>Office: Salisbury Laboratories, 332

<br>Phone: 1-508-831-5513

<br>Fax: +1-508-831-5932

<br>jdempsey@wpi.edu

</td>

<tr>

<td align="center">

James Dempsey

</td>

</tr>

</table>

<table class="personleft">

<tr >

<td width="180">



</td>

<td rowspan="2" valign="top">

<br>meyerk@wpi.edu

</td>

<tr>

<td align="center">

Keith Meyer

</td>

```
        </tr>
</table>
<table class="personleft">
  <tr>
    <td width="180">
      
    </td>
    <td rowspan="2" valign="top">
      <br>dwights@wpi.edu
    </td>
  <tr>
    <td align="center">
      Dwight Santimore
    </td>
  </tr>
</table>

</body>
</html>
```