March 2011

Barbed Wire Museum

Alex H. Kuang

Worcester Polytechnic Institute

Follow this and additional works at: https://digitalcommons.wpi.edu/iqp-all

Repository Citation
Barbed Wire Museum

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:

Alex Kuang

February 28, 2011

Major Advisor:
Professor James Dempsey
Abstract

The previous attempt at a barbed wire website detailing the importance of barbed wire to the economical and industrial development of Worcester, the North Works site, was full of errors and sparse in information. This project attempts to remedy this by improving the website’s aesthetic appearance, fixing the grammatical and coding errors, adding to the existing information, and establishing groundwork for future expansion. The result is a much cleaner looking site hosted on the WPI network, ready to be augmented by content created by future students.
Contents

Introduction ................................................................. 3
Methodology ................................................................. 4
Essay - The Devil’s Rope: Barbed Wire and Conflict .................... 6
Works Cited ................................................................ 7
Documentation For Future Students ...................................... 8
Conclusion and Recommendations ....................................... 10
Appendix A: build.py .................................................... 11
Appendix B: header.html ................................................ 13
Appendix C: footer.html .................................................. 15
Appendix D: barbedwire.html ............................................ 16
Appendix E: bib.html ....................................................... 17
Appendix F: bw_glossary.html .......................................... 20
Appendix G: contacts.html ................................................ 23
Appendix H: essays.html .................................................. 24
Appendix I: history.html .................................................. 25
Appendix J: index.html .................................................. 31
Appendix K: nw_gallery.html .......................................... 32
Appendix L: nw_intro.html .............................................. 33
Appendix M: people.html ............................................... 35
Appendix N: conflict.html .............................................. 38
Introduction

The development of barbed wire had a major impact on the development of the city of Worcester. The revenue brought in by the North Works factory contributed to the economic development of Worcester; in fact, the founder of the North Works factory, Washburn, would later go on to become one of the greatest donors of Worcester Polytechnic Institute. Furthermore, his engineering-based entrepreneurial spirit would later inspire such alumni as Theo Brown, who played a significant role at the John Deere tractor company.

Given its role in the history of Worcester and WPI, it is only appropriate that there be a website dedicated to barbed wire-related information, especially in relation to Worcester. One such attempt was made by two previous WPI students at the North Works website (http://northworkshistory.com). However, the website’s appearance was archaic, and its code not compliant with web standards. In addition, the information was sparse and limited, and it was hosted privately, so it would not be easy to expand. This made it a very flawed both as a website and as a source of information for people interested in barbed wire.
Methodology

The first issue that had to be addressed was one of hosting; the website would ideally be hosted somewhere that would make it easy for future authors to access. This requirement made the WPI servers the best choice. By virtue of being hosted on WPI’s webservers, the account could be accessed by multiple people on campus. In addition, server uptime and security would be taken care of by the university’s staff, and ownership of the account could be easily transferred from one student to another (or to the advisor) as contributors graduated.

The next major step involved web standards. The old website was written in non-standard HTML, which meant that it was unstable and not guaranteed to render the same way on all browsers. In addition, non-standard code is not supported for longevity and has a high chance of breaking with any browser upgrade. Thus, the next move was to port all existing site content to a more standards-compliant format. This step also coincided with the aforementioned stylistic issues; the website lacked a clean appearance, so the layout had to be redesigned and recoded from scratch. Thus, the website was ported over to a cleaner layout, written in standard XHTML, with no change to the content and images.

On further reviewing the content, it was found to be full of spelling and grammatical errors. These were amended, with great effort taken to leave stylistic elements unchanged. However, this was unfeasible with some cases. Changes were also made to the organization of the content were made so that the website would be easier to navigate. The homepage was re-done to give a better idea of the scope of the site, and to link to introduction pages for first-time viewers. A new introduction page was created for the North Works, so that viewers would not have to
immediately dive into a wall of text detailing the history of the factories. Images on all of the pages were reorganized so that they flowed with the text more naturally. And finally, the Works Cited information was lifted from the Contacts page and into its own page, for clarity and because with future expansion it has the potential to be much larger than it already is.

With the above changes, a functional and stable copy of the website existed on the WPI’s servers. The final part of this project was a section dedicated to barbed wire in general (as opposed to just the North Works factory). Under this section were a brief introduction and a glossary of commonly used barbed wire terms. In addition to this, a page was added to serve as an index for essays on barbed wire, with one essay to start.
Essay - The Devil’s Rope: Barbed Wire and Conflict

As the essay is published on the website, it is best that it be viewed there, with the accompanying images, to preserve the format. The source code (with links to the images) may still be found in Appendix N, however.
Works Cited

The full works cited page may be viewed online. For the full works cited at the current time of writing, view Appendix E.
Documentation For Future Students

This section will focus on everything a future student may need to know in order to work on the site as it currently stands at the time of this writing (February 2011).

The website is hosted on the WPI CCC server. The URL is http://users.wpi.edu/ northworks. The server can be accessed via ssh, using the command: ssh northworks@ccc.wpi.edu. It can also be done using a client such as PuTTY, or via WPI’s networked hard drive functionality. Additional methods of access may be available; contact the help desk or the ATC for more information. The password to the group account can be obtained from Professor Dempsey, but if it gets lost then the help desk should be able to reset it, or at least change ownership of the account for someone else to reset it.

Everything of importance is under the public_html directory (references to original source code can be found in the appendices). Instead of maintaining multiple HTML files, I chose to write a script to do it instead. The script is build.py; in layman’s terms, it takes a pre-defined header file (inc/header.html) and a pre-defined footer file (inc/footer.html) and fuses it with content files to produce the pages to be viewed. This is so that changes to the link structure of the site will not necessitate many actual file changes; for example, if a new “gallery” page is added to the navigation bar, using this method will only require editing 1 file (inc/header.html) instead of the navigation bar code for all the pages on the site. This script was build because WPI’s support for PHP (and more complex web frameworks) is rather shady at the moment, and it seemed like the easiest solution.

Thus, the actual files you will want to edit are all in the inc folder. The permissions
for the inc folder and for build.py are set such that the public cannot reach them via the web.

inc/header.html contains all navigation bar and css import information, while inc/footer.html simply finishes off the page and adds a w3c html validation link for confirmation. inc/content is where all the relevant files for the content are. So as an example, to add the gallery page mentioned above, a file would be placed inside inc/content, then a link added in inc/header.html. Then, the command ”python build.py” would be run in the command line (ssh) from inside public_html, and the pages would all update and have the link to the new gallery page.

Of course, use of this system is up to the student’s discretion. It can be scrapped, but I feel this is more convenient. Other than this, everything should be self-explanatory; the only anomaly is the old directory, which houses the previous North Works site for reference purposes. If there are any more questions, most likely someone at the help desk can answer them.
Conclusion and Recommendations

The result of this project is a working site on the WPI servers dedicated to the North Works factory in Worcester and barbed wire in general. The errors in spelling, grammar, coding, and information have been removed, and the website augmented with more content and redesigned to be more user-friendly. It should serve as a much more reputable source of information on barbed wire and its relation to Worcester history.

For future projects involving this site, the author recommends that all students read the Documentation section of this paper. The most pressing concern (as of this writing) is to add more essays on barbed wire, and more content in general; for example, the existing information on the history and people of North Works could definitely be fleshed out more. In addition to writing, contributions in media would also serve the website well. More quality photographs of the barbed wire factories, both from the past and in the present would make the website a more live experience. The site could also benefit from the addition of gallery pages; for this, existing images would have to be standardized and new images be sourced (either via the internet or live photography) to give the gallery sufficient content. Of course, the above are only a few of the more obvious concerns at this time; the number of areas into which the website can expand is considerably larger, but hopefully these will give any prospective students some ideas.
import os

if __name__ == "__main__":
    # List of content files
    files = os.listdir('inc/content')
    files.remove('essays')

    # Read header and footer files
    fp = open('inc/header.html')
    header = fp.read()
    fp.close()
    fp = open('inc/footer.html')
    footer = fp.read()
    fp.close()

    # Build website. For each file found in content, build a page
    # with header,
    # then content, then footer.
    for filename in files:
        fp = open('inc/content/%s' % filename)
        content = fp.read()
        fp.close()
        fp = open(filename, 'w')
        fp.write(header)
        fp.write(' <div id = "content">
        fp.write(content)
        fp.write(' </div>
        fp.write(footer)
        fp.close()

    # Build essays. Automatically draws on everything in inc/
    # content/essays
    # and builds the corresponding file in the essays folder displayed
    # in the main directory.

    # To account for extra essays directory
    header = header.replace('href="",'href="../")
    files = os.listdir('inc/content/essays')
    for filename in files:
fp = open('inc/content/essays/%s' % filename)
content = fp.read()
fp.close()
fp = open('essays/%s' % filename, 'w')
fp.write(header)
fp.write('<div id = "content">
')
fp.write(content)
fp.write('</div>
')
fp.write(footer)
fp.close()

# For reference. A quick gallery building script.
# fp = open('bw_gallery.html', 'w')
# fp.write(header)
# fp.write('<div id = "content">
# inames = os.listdir('nw_images')
# for n in inames:
#     fp.write('<a href="nw_images/%s">%s</a>
#     <img src="nw_images/%s" alt="%s"/>
#     </a>
# </div>
# fp.write(footer)
# fp.close()
Appendix B: header.html

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<!-- Alex Kuang
North Works Website
-->  
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
<title>North Works</title>
<link rel="stylesheet" type="text/css" href="style.css" />
</head>
<body>
<div id="container">
<div id="topban">
<h1>North Works</h1>
</div>
<div id="navbar">
<!-- The below is just to implement floating sub-menus. See CSS for details. -->
<ul>
<li><a href="index.html">Home</a></li>
<li><a href="nw_intro.html">North Works</a>
<ul>
<li><a href="nw_intro.html">Introduction</a></li>
<li><a href="history.html">History</a></li>
<li><a href="people.html">People</a></li>
<li><a href="nw_gallery.html">Gallery</a></li>
</ul>
</li>
<li><a href="barbedwire.html">Barbed Wire</a>
<ul>
<li><a href="barbedwire.html">Introduction</a></li>
<li><a href="essays.html">Barbed Wire Essays</a></li>
<li><a href="bw_glossary.html">Glossary of Terms</a></li>
</ul>
</li>
<li><a href="contacts.html">Contacts</a></li>
</ul>
</div>
</div>
</body>
</html>
Appendix C: footer.html

</div>

<p style="text-align:center;">
<a href="http://validator.w3.org/check?uri=referer">
<img style="border:0;" src="http://www.w3.org/Icons/valid-xhtml10" alt="Valid XHTML 1.0 Transitional" height="31" width="88" />
</a>
</p>

</body>

</html>
Appendix D: barbedwire.html

Barbed wire is a type of fencing constructed with sharp points (or "barbs") lining its length at regular interval. Despite the simplicity of the concept, the invention of barbed wire has had wide-reading impacts on society. It affected war with its use in the World Wars, both in trenches and in concentration camps. It affected animal husbandry, by virtue of its efficacy in restraining livestock. It also had wide economic effects, being one of the driving forces in manufacturing in the Industrial Revolution; the economy in Worcester MA would not be the same without the presence of the barbed wire manufacturing factories.

Barbed wire is still being used in modern times. It is now commonly used as human-proof fencing in prisons. Because of it is cost-effective and simple to implement, barbed wire remains the de facto standard for fencing technology not only for restraining cattle, but in regions where animals are common as well. In addition to this, over the years the hobby of collecting barbed wire has developed as well, with many museums and collection dedicated to this artifact.

(Image courtesy of the Devil’s Rope Barbed Wire Museum)
Appendix E: bib.html

<h2>Works Cited</h2>

<br />
<br />


Vallely, Paul. Tom Wright: It’s not a question of left and right, says the combative priest who opposes the war in Iraq and gay bishops. <i>The Independent</i>, December 29 2003.


Appendix F: bw_glossary.html

<h2>Barbed Wire Glossary of Terms</h2>

<u>Antique Barbed Wire</u>: Wire manufactured before 1925
<br />

<u>Barb Applier</u>: Hand tool used to arm fence strands with barbs, usually on older smooth wire.
<br />

<u>Barbed Wire</u>: Strands or ribbons of wire with attached barbs.
<br />

<u>Concertina Wire</u>: Masses of military wire strung out to create barriers.
<br />

<u>Cut</u>: The accepted measurement for collection barbed wire is an 18" piece with the barbs being equal distance from each end. Specimens should not be less than 18". Due to the features of some pieces it may be necessary for the cut to be of longer length.
<br />

<u>Electric Fence</u>: Normally a single line wire carrying an electrical charge that shocks intruders. Includes a charger, grounding rod, and insulators. Electrified lines of barbed wire at the top of fences have been successful.
<br />

<u>Entanglement Wire</u>: Masses of military wire used to create barriers.
<br />

<u>Fence Post</u>: Set in the ground to provide vertical support for wire fencing. Can be wood, vinyl, steel, concrete, or other materials.
<br />

<u>Fence Tool</u>: Instrument used to assist in building fences, splicing and cutting wire, and other related operations.
<br />

<u>Fence Tops</u>: Decorative ornament that is on top of a fence post.
<br />

<u>Freak Wire</u>: Defective wire resulting from lack of quality control at a wire factory. Usually caused by worn shears, worn dies, and malfunctioning machinery.
<br />

<u>Horse Wire</u>: Barbless wire used for fencing that is not intended to harm horses.
Human Wire: Barbed wire with shorter, movable, or less harmful barbs manufactured such that livestock will not be injured.

Irregular wire: Wires with factory errors such as extra barbs, unevenly spaced barbs, or line wire variations.

Left Hand Twist: Barbed wire strands (or barbs) twisted in a counter-clockwise direction.

Length: See "Cut."

Military Wire: Barbed wire manufactured with features geared towards restraining and inflicting disabling harm on enemy troops.

Moonshine Wire: Illegally made wire. Either patented wire made without consent of the patent owner, or wire produced that was never patented.

Net Wire: Wire designed to control smaller game, animals, and birds. Height ranges from a few inches to over six feet.

Ornamental Wire: A wire without barbs used for ornamentation. Often used around cemeteries.

Planter Wire: Generic term used to describe all forms and materials of check-row, check-line, and related knots.

Punch Press: Continuous metal strap with various designs stamped out. Used for decorative fencings and stays.

Right Hand Twist: Opposite of "Left Hand Twist."

Sheet Metal Barbs/Wire: Barbs or wire stamped out of metal rather than being rolled.

Shorty Wires: A short cut of wire, generally 4.5in long, displayed in collections.

Signal Plate: Also known as "warning plate." A means of wire fencing used to make the fence more visible to livestock.

Splice: Joining two pieces of wire.

Stays: Vertically installed wire, rod, ribbon, or slat between two posts for the purpose of keeping fence wire separate and tight.

Stretcher: Fence tool developed to stretch and
tighten wire.
<br /><br /><u>Tag</u>: Metal plate attached to new rolls of wire that gives information about the manufacturer of the wire as well as the wire itself.
<br /><br /><u>Tightener</u>: A mechanical device placed on a post to twist the wire to its original tension.
<br /><br /><u>Top Runner</u>: Top strand of a wire fence.
<br /><br /><u>Warning Plate</u>: See "Signal Plate."
<br /><br /><u>Wire Gauge</u>: Device that measures the size of a cross-section of wire.
<br /><br />
<p>(Tremblay &amp; Dempsey 2009)</p>
### Appendix G: contacts.html

```html
<h2>Contacts</h2>
<table>
  <tr>
    <td><img src="dempsey.jpg" alt="Dempsey"></td>
    <td><p>James Dempsey <br>Office: WPI Salisbury Labs, 332<br>Phone: 1-508-831-5513<br>Fax: 1-508-831-5932<br>jdempsey@wpi.edu</p></td>
  </tr>
  <tr>
    <td><img src="meyer.jpg" alt="Meyer"></td>
    <td><p>Keith Meyer <br>meyerk@wpi.edu</p></td>
  </tr>
  <tr>
    <td><img src="dwight.jpg" alt="Santimore"></td>
    <td><p>Dwight Santimore <br>dwights@wpi.edu</p></td>
  </tr>
</table>
```
Appendix H: essays.html

Below is a collection of essays on various topics related to barbed wire. This collection will be added to over time.

<a href="essays/conflict.html">The Devil’s Rope: Barbed Wire’s Role in Human Conflict (Alex Kuang, 2011)</a>

(Image courtesy of the Devil’s Rope Barbed Wire Museum)
Appendix I: history.html

<h2>A Small Beginning (1830)</h2>
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 Goddard 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.

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.

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.

<h2>Expanding the Business (1850)</h2>

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.

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. </p>
<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).</p>
<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 &amp; 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).</p>
<p>As early as 1867, Washburn &amp; 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).<h2>A New Market (1874)</h2><p>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 2,000 pounds, 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 &amp; 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 &amp; Moen Manufacturing Company and Isaac L. Ellwood, giving them free reign for barbed wire production and licensing to other manufacturers (Washburn 157).

A Final Merger (1899)

Copper wire production at the Washburn &amp; 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 1890s 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 &amp; Wire Co. purchased Washburn &amp; 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) </p>
Appendix J: index.html

Welcome to the North Works website, a website dedicated to the North Works factory established by Ichabod Washburn in 1830. Here, you will find the history of barbed wire manufacturing in Worcester, as well as information about barbed wire in general.

For those who are unfamiliar with the North Works factory, there is a brief introduction available, and for anyone new to barbed wire, our introduction and glossary pages may be good places to start.
Appendix K: nw_gallery.html

<img src="nw_images/charlesf.jpg" height="350" alt="charlesf.jpg"/>
<img src="nw_images/charles.jpg" height="350" alt="charles.jpg"/>
<img src="nw_images/henry.jpg" height="350" alt="henry.jpg"/>
<img src="nw_images/moen.jpg" height="350" alt="moen.jpg"/>
<img src="nw_images/rice.jpg" height="350" alt="rice.jpg"/>
<img src="nw_images/washburn.jpg" height="350" alt="washburn.jpg"/>
<img src="nw_images/centralworks.jpg" width="750" alt="centralworks.jpg"/>
<img src="nw_images/northworks.jpg" width="750" alt="northworks.jpg"/>
<img src="nw_images/southworks.jpg" width="750" alt="southworks.jpg"/>
<img src="nw_images/north_works.jpg" height="350" alt="north_works.jpg"/>
<img src="nw_images/north_works_station_1.jpg" height="350" alt="north_works_station_1.jpg"/>
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 and bringing in more revenue. Through many mergers the building became a part of a nationwide market for the wire business, creating a monopoly on barbed wire products. This massive growth began very humbly, starting with two gentlemen and increasing to a workforce numbering in the thousands.

Washburn began the manufacturing of barbed wire in the 1830s with the North Works factory funded by local businessman Steven Salisbury. Throughout the years, he would continue to refine and perfect the process. It was followed by the Central Works on Cambridge Street. By the time the South Works (also known as the Quinsigamond Iron and Wire Works) was built on Lake Quinsigamond in 1847, the factories were owned under the new company Washburn & Moen Manufacturing Co. The ownership of these factories would not change from there until 1899, when the American Steel & Wire Co. would purchase Washburn Moen & Co. In 1870, the Central Works would be dismantled, and the parts distributed between the remaining North and South works, only to be purchased 4 years later by William E. Rice, operating separately from Washburn & Moen until the big merger in 1899. By 1873, despite the loss of the Central Works Washburn & Moen were collectively producing 15 tons of wire per day.

Although the factories would eventually be deemed unnecessary and closed by US Steel in 1970s, their presence still had great economic effects on Worcester. For example, in 1881 alone barbed wire licenses would earn Washburn & Moen $334,642 in royalties, damages, and bonuses. In addition to this, the monopoly the company had on barbed wire (as the first anti-trust laws would not come around until about 1890) allowed them to oust competitors out of the industry due to rising material costs, which brought them a huge profit as well. Washburn & Moen’s company would serve to kick off the Industrial revolution in Worcester. Their success let the city of Worcester thrive, and would later inspire engineers and entrepreneurs such as WPI’s Theo Brown...
the John Deere tractor company."
Ichabod Washburn was one of the founders of the Worcester Mechanics Association and principle donor of Mechanics Hall, Memorial Hospital and Worcester Polytechnic Institute. He was one of the city’s first manufacturers when he opened up a ramrod shop in Worcester in 1819. Often said to have had a desire for improving all things mechanical, he was 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 years as Nathan Muzzy’s apprentice, eventually earning the title Journeyman Blacksmith. In the spring of 1819 Ichabod began working at the Millbury Armory where he hammered alongside his future business partner Benjamin Goddard (Warren 7-8).

Philip L Moen was born in Wilna, New York. He attended multiple schools preparing him to go to Columbia University; however he developed an interest in the hardware trade which would aid in his move to the Washburn & Moen Manufacturing Company. He traveled to Worcester to marry Ichabod Washburn’s daughter, who he met at the anniversary of the American Board of Foreign Missions (Crane 55). He possessed a keen eye for business which complemented Ichabod’s mechanical mastermind beautifully. In 1846 Ichabod made him partner with Henry S. Washburn of the South Works Factory. Philip acted as Ichabod Washburn’s business side, and aided in increasing the worth of the manufacturing plant, helping to expand it through various business transactions. He held was the 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 regardless of 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).<p><br /><hr /></p><p>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 Manufacturing Co. and soon would control the South Works factory with his cousin Henry S. Washburn. His final position in the company was as director from 1868 to 1875. </p><br /><br /><br /><br /><br /><hr /><br /><p>William E. Rice worked for Ichabod Washburn 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 &amp; Company at the site of what would become the South Works Factory. This venture failed to last due to a water power shortage and the plant was relocated to Holyoke, MA being replaced with a wire mill. Five years later the Holyoke building was sold to be used as a paper mill. The wire drawing equipment was purchased as part of a deal by Ichabod’s company; 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 after all of the technical issues were worked out. Rice held the position of President of Washburn &amp; Moen Manufacturing Company from 1891 until 1899 when the company was sold to American Steel and Wire in 1899 (Warren 18-19).</p><br /><hr /><br /><p>Charles F. Washburn was known to be gentlemanly, genial,
concilialatory, optimistic, 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. Thanks to his ambition for knowledge, he became a self educated man by reading 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 & Moen when it was restructured in 1865 and was known for using his vision and enthusiasm to fuel development efforts and maintain the company’s place in competition. 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 a member of the Board of Trustees of Memorial Hospital (Warren 15-16).
Appendix N: conflict.html

<h3>The Devil’s Rope: Barbed Wire’s Role in Human Conflict</h3>

Fences have always been about separation. The very essence of a fence is to keep "them" away from "us", or to protect what is "ours". In that way, fences represent the root of conflict between men. The invention of barbed wire only further emphasized this by making it much easier not only to create boundaries, but to hurt any who try to trespass them. It facilitated territorial expansion and control, the incarceration of men, and international conflicts.

![Treblinka concentration camp](http://img88.imageshack.us/img88/5876/screenshot20110221at348.png)

(Left image: model of Treblinka concentration camp, Melbourne Museum. Image courtesy of the Devil’s Rope Museum.)

At its inception, the concept of barbed wire seemed fairly innocuous; it was originally proposed as a means of confining animals. The invention didn’t really take off, however, until the great western expansion, where the containment of livestock (such as cattle on railroad tracks, as well as livestock trampling the crops of farmers) necessitated a cheap, easy form of fencing. As traditional fencing materials such as wood and stone were not available on the plains, barbed wire served as the ideal solution. It is worth noting that even then, ranchers were commonly using barbed wire against not only livestock, but against other farmers and ranchers from invading their territory. (Krell 2002, p19) This is led to what was known as "range wars" between various ranchers and farmers, which ended in legislation penalizing the destruction of barbed wire fences, and ended the era of the "wild west" free ranges of America.

The first recorded major use of barbed wire in combat was in the Boer Wars, fought between the British Empire and two Boer republics. Barbed wire played a large role here in being used for defense, and to control space in the battlefield. In a description of the Battle of Modder River fought between the British general Lord Methuen and the South African general Piet Cronje, Alfred Kinnear writes, "... discharging of their guns at the hustling crowd of human deer impaled upon Cronje’s wicked barbed wire ..." (Kinnear, p93) This description already implies much about the general attitude towards the use of barbed wire in armed combat; the use of the phrase "human deer" as well as the description of the wire itself being "wicked" implies a connotation of evil and inhumanity in the invention’s use in war.

In World War I, where barbed wire played a pivotal role in the way combat was conducted. Much like in the Boer war, barbed wire played a major part in the structure of defensive fortifications, and was used to surround areas of space for control. However, in the case of World War I, trench warfare was the de facto way of battling. Bunches of barbed wire were placed in trenches to prevent charging on the trenches. Since it was cheap, it could be
left there to be bombarded, and because of the nature of clumps of wire, enemy gunfire didn’t do much to damage the overall structure of the defenses. This led to the development of heavily padded infantry wading through clumps of barbed wire to cut them and bring down the enemy’s defenses (Krell 2002, p60). This combination of using the entangling and harmful qualities of barbed wire in combination with the defensive properties of trenches and the heavy use of extremely quick and destructive machine guns, contributed heavily to the high casualty numbers and the "never-ending" nature of trench battles.</p>

The use of barbed wire is not limited to combat alone. There is another aspect of conflict in which it was used widely: imprisonment. In the Boer War, barbed wire was used to surround camps of captured Boers. But it was also used in the considerably more infamous camps of Nazi Germany: the concentration camps of Jews. Because of technological advances like the widespread use of tanks, barbed wire’s effectiveness in battle diminished by the time World War II had started. However, its cheapness, ease of use, and effectiveness still made it the ideal solution for imprisoning Jews, much like it was the ideal solution for imprisoning cattle.</p>

Jewish concentration camps’ fences were electrified to keep people inside, and the infirmaries where experiments were performed were also separated from the rest of the camps with barbed wire; in this case, they were to keep prying eyes out. A model of one such camp, Treblinka, now sits in the Jewish Holocaust Museum in Melbourne (Krell 2002, p78-79). Americans used barbed wire as well, on the Japanese citizens of the US. In February 1942, President Roosevelt issued Executive Order 9066, which put millions of Japanese Americans into internment camps under the pretense of evacuation. Walls topped with wire and armed guards supported the words of President Roosevelt; in the Manzanar camp alone, over 10,000 Japanese Americans were imprisoned without due process of law (Okamura 1982).</p>

<img src="http://www.independent.co.uk/multimedia/dynamic/00549/7-Police_549283s.jpg" alt="Egypt protestors" style="float:right;" />

(Right image: Crowds surrounded by barbed wire during the recent protests in Egypt. Image courtesy of The Independent, original page)

The image of barbed wire in modern times is symbolic of oppression and unnecessary cruelty. This is due to its continued use in prisons and other such facilities; barbed wire’s low cost and efficiency in controlling space and
restraining people has not diminished in the slightest over time. Even in modern war, its use in prison camps has not diminished; for example, barbed wire has a prevalence in the Israeli-Palestinian conflicts, with Bishop Tom Wright commenting, "Well I’m sorry, but if you put people behind barbed wire, keep them caged, take their land despite international resolutions, and bulldoze their homes, you are asking for trouble." (Vallely 2003) It was also used more recently during the protests in Egypt, where crowds of protestors were surrounded by barbed wire and armed police guards.

Outside of combat, barbed wire is also still being used in the American southwest, and as a form of fencing for anybody seeking a cheap and affordable device for deterring trespassers. Indeed, it is so effective that protest groups have formed, both for animal and human rights, protesting its use. In response to this, European countries have now begun restricting its use due to the risks of injury that it poses (Daily Mail 2008). Despite this, however, it is still being used in cases of home defense as a deterrent to burglars.

Given how barbed wire has been central to human conflict from its creation to the modern day, it’s no surprise that its image has developed as something negative and oppressive. There is now a considerable body of work documenting the historical events in which barbed wire were used, as well as just the cultural and anthropological history of the wire itself. Much of it is negative, involving imagery such as "... out a window and through a thin film of snow[, he] saw barbed wire fences and empty fields." (Potok 1981) References to tall walls and barbed wire are often used in descriptions of oppression and confinement, and the image of humans being as animals trapped and shredded by barbed wire is often used almost to the point of being cliche. In fact, the epithet "devil’s rope" was initially coined by religious groups in response to seeing injuries caused to livestock who ran afoul of fences made of barbed wire (Devil’s Rope Museum 2007). While it may have been exaggerated at the time, given the role that barbed wire has played in conflict in general, perhaps that name is appropriate after all.