



# TOOLS & TECHNOLOGY

AMERICAN PRECISION MUSEUM • WINTER 2009

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The American Precision Museum is open daily 10am-5pm, Memorial Day weekend through October.

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## The Waterwheel Pit and Millwork at the Robbins & Lawrence Armory, 1846

In 2007, with a grant from the Society for Industrial Archaeology and funding from several generous donors and trustees, the museum engaged the Historic American Engineering Record (HAER) in Washington DC to document the remains of the waterwheel pit and millwork at the Robbins & Lawrence Armory, home of the American Precision Museum. Christopher Marston, HAER architect, led the project, in collaboration with John Johnson, an industrial historian from Marshfield VT.

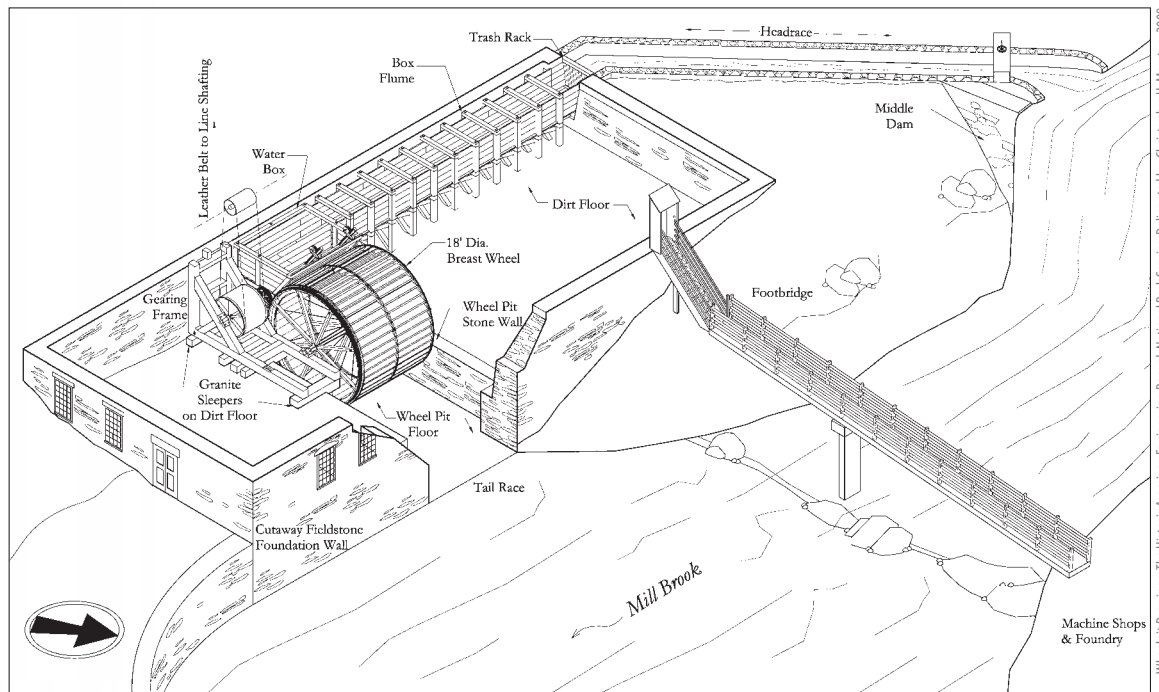
HAER was established in 1969 by the National Park Service, the American Society of Civil Engineers and the Library of Congress to document historic sites and structures related to engineering and industry. This HAER project is comprised of a written report, providing context for historical, technological and archaeological aspects of the site's significance, photographic documentation

of existing conditions, and interpretive drawings to reconstruct what may have existed. The final report and drawings will later be archived at the Library of Congress American Memory site in the HAER collection.

The Robbins & Lawrence installation was typical of an 1840s waterwheel in northern New England, and the remains of the waterwheel pit and millwork are a case study in a water-power system of a mid-19th century factory in New England. Evidence from the study adds to the understanding of similar factories constructed at this time.

The Armory was constructed in Windsor, Vermont in 1846 as a private armory for the manufacture of firearms and machine tools to make those firearms. The period of significance for the Armory was 1846-1856. During this period

**The Waterwheel Pit** continued on page 4



**Water Wheel Isometric**, historic view circa 1846

Wheel pit Drawings: The Historic American Engineering Record, National Park Service. Delineated by Christopher H. Marston, 2008.



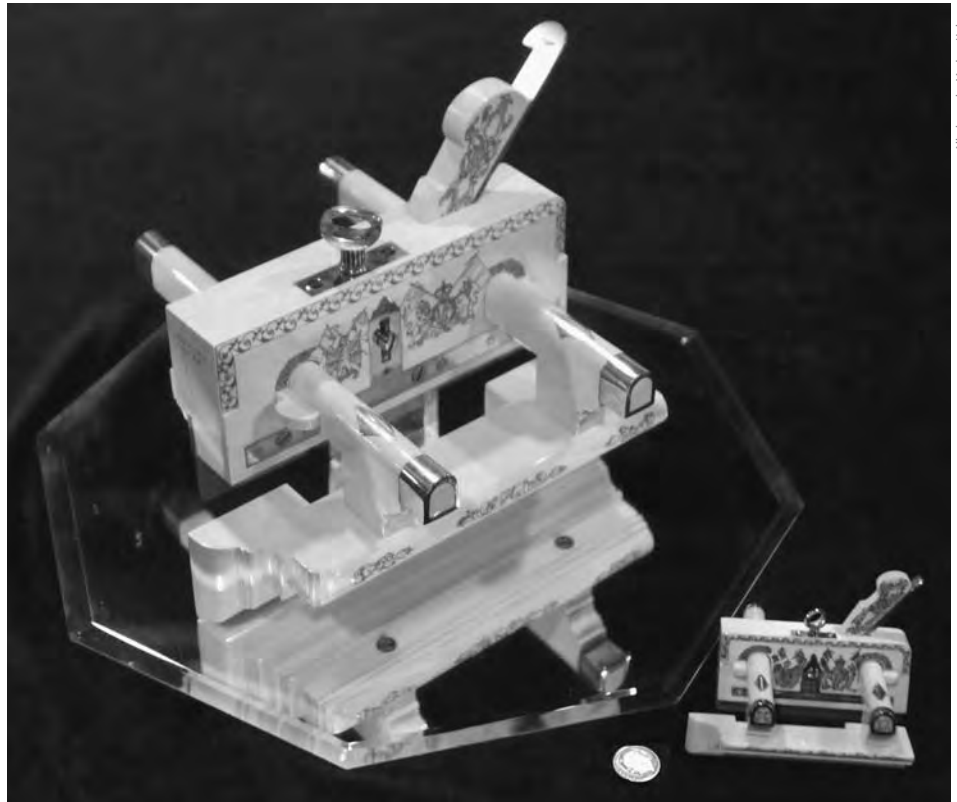
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# Museum Celebrates 10th Anniversary of Model Engineering Show

Perfection is the hallmark of the model engineering and miniature movement, and visitors to the October 31st show experienced some of the best.

Paul Hamler from Blairsville, Georgia, is considered one of the finest miniature makers in the country. Visitors were enthusiastic about his handmade copies of antique pedal-powered wood-working tools and his full-sized replica of John Moseley's sterling silver and ivory presentation plow plane made for the 1855 Paris exhibition at the Palais D'Industrie. With its sterling silver mounts and ornate scrimshaw decoration, Hamler made this replica using old photographs as a guide. It is considered to be one of the fanciest tools ever made for exhibition.



All photos by Medina Hebert

*John Moseley & Son presentation plow plane and miniature, Paul Hamler*



*Treadle-powered scroll saw, Paul Hamler*



*Miniature smoothing plane, Paul Hamler*



*Janet Collins, a custom furniture maker from Ryegate VT, demonstrated wood texturing techniques.*



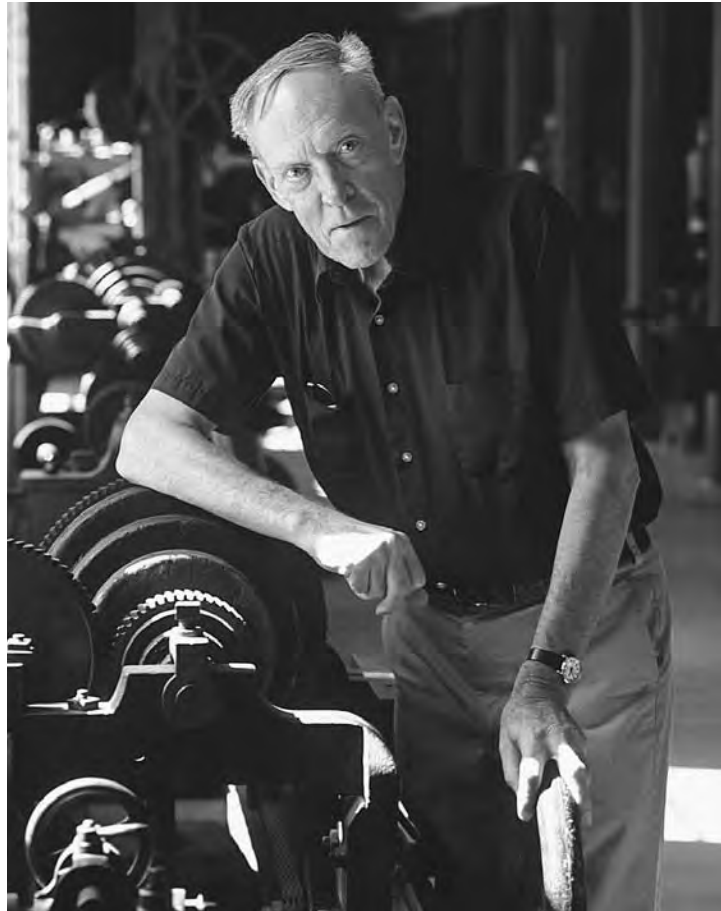
*Pete Renzetti, an enthusiastic exhibitor, from Delaware*

# Celebrating A Life: Edwin Albert Battison

On Saturday, August 29th, friends, colleagues and former students honored Battison's memory at his Windsor home, now the site of the Franklin Museum of Nature and the Human Spirit, which he founded in 1991. Although the Franklin is not open to the general public, it holds Battison's personal collections of machine tools, clocks and watches, some of which were on display for guests that afternoon. Franklin Museum Chair, Jay Boeri, noted that Battison's talent for recognizing technological turning points formed the basis for his collecting.

Former students Dr. Merritt Roe Smith, now a professor of the History of Technology at MIT, Dr. Donald Hoke, a scholar and museum director from Dallas and Mary Ann Johnson of Windsor, each spoke of Battison's generosity as a teacher. They remarked on his style as a researcher who practiced first-hand examination of artifacts to unlock their significance, and the importance of his contributions to historical scholarship.

The American Precision Museum, founded by him in 1966, stands today as a tribute to Ed Battison and his genius. The 1846 Robbins & Lawrence Armory was designated as a National Historic Landmark during his tenure as Director. In 1986, in recognition of the significance of the museum's collection of machine tools, the American Society of Mechanical Engineers recognized it as the First International Mechanical Engineering Heritage Site and Collection. With the exception of the years he lived in the Washington DC area working at the Smithsonian, he lived in Windsor his entire life.



Edwin Battison at American Precision Museum in 1985

photo by Jon Gilbert Fox

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Edwin Battison  
(1915-2009)

*From: Peter Smithurst, Curator Emeritus,  
Royal Armouries Museum, Leeds, England and  
APM Executive Director 2001-2002*

“...But regardless of his ways, if he did nothing more than found the American Precision Museum..., he saved a vastly important landmark in America's industrial heritage and filled it with equally important landmarks in the evolution of precision manufacturing. The collection which Ed was largely instrumental in putting together and, which is so important to America's heritage, is also important worldwide, representing as it does the birth of modern manufacturing with the development of interchangeability in gun making, and probably has no equal anywhere. His dedication to his cause was unwavering.”

*The American Precision Museum, founded in 1966, preserves the heritage of the mechanical arts, celebrates the ingenuity of our mechanical forebears, and explores the effects of their work on our everyday lives. The museum is housed in the original 1846 Robbins and Lawrence Armory in Windsor, Vermont. The Armory was designated a National Historic Landmark in 1972. The museum holds the largest collection of historically significant machine tools in the country.*



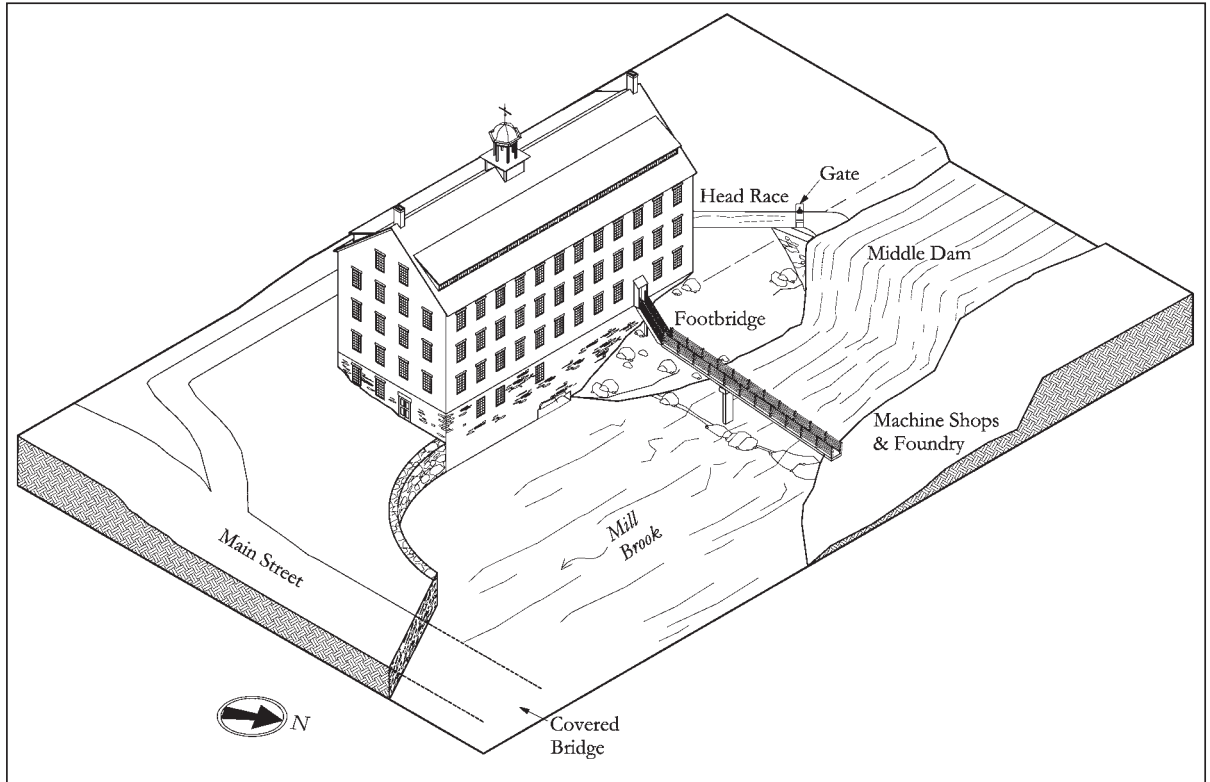
**The Waterwheel Pit** *continued from page 1*  
 the 'American system of manufacture' was employed here by skilled machinists with a variety of machine tools necessary for the manufacture of interchangeable parts.

On site fieldwork and additional research indicate that the Armory was

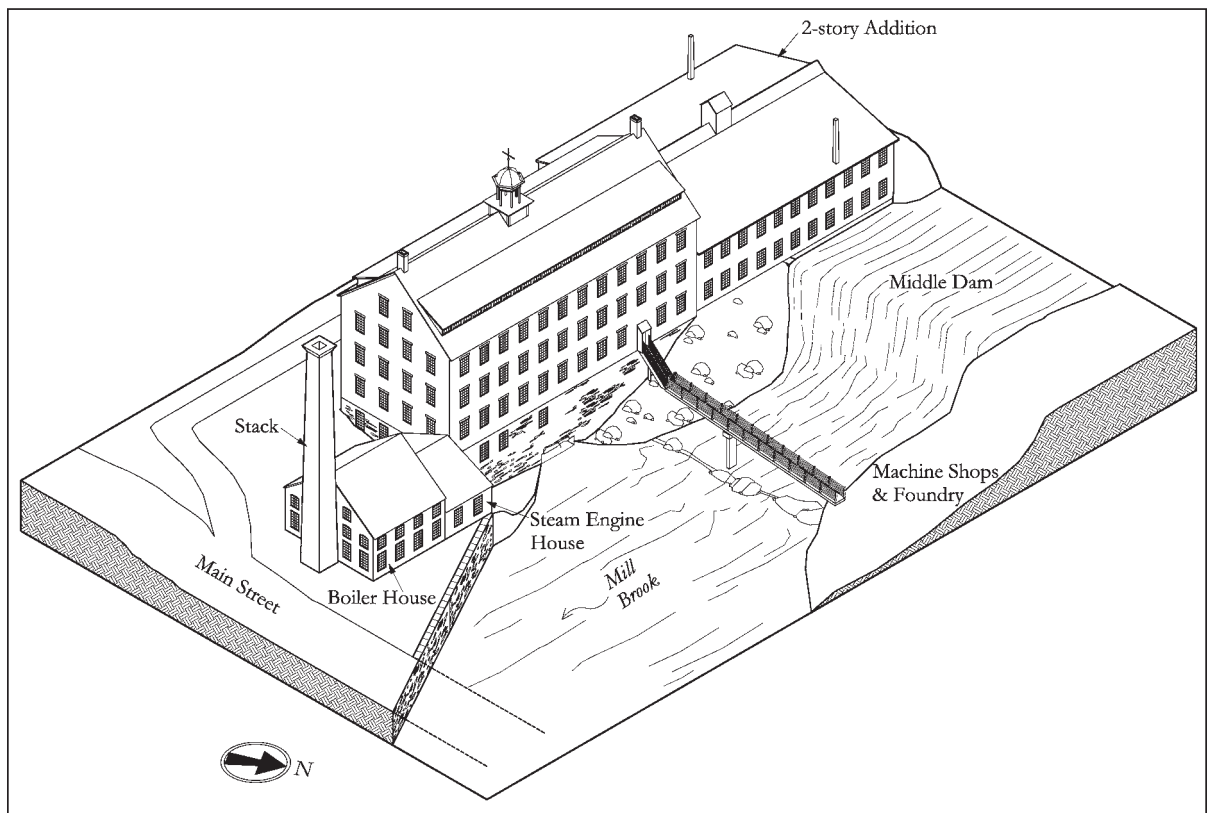
originally powered by a high, breast type, wood and metal water wheel 14' wide and 18' in diameter, that supplied mechanical power for the woodworking and metalworking machines used in the manufacture of Government-contracted firearms. Power from the water wheel was directed to a partially extant gearing frame set on

granite blocks near the southeast edge of the extant wheel pit. Power from the gearing frame was directed to machinery on the first floor of the factory. While most of the conjectural drawings in the report focus on the millwork in the period of significance for the Armory, other drawings illustrate major changes to the

**1846 Robbins & Lawrence Armory.** Original 4 story brick factory, connected by foot-bridge to machine shops and foundry across Mill Brook.



**1853 Robbins & Lawrence Armory.** Expanded with 2 story manufacturing addition, plus chimney stack, boiler, and steam engine house.



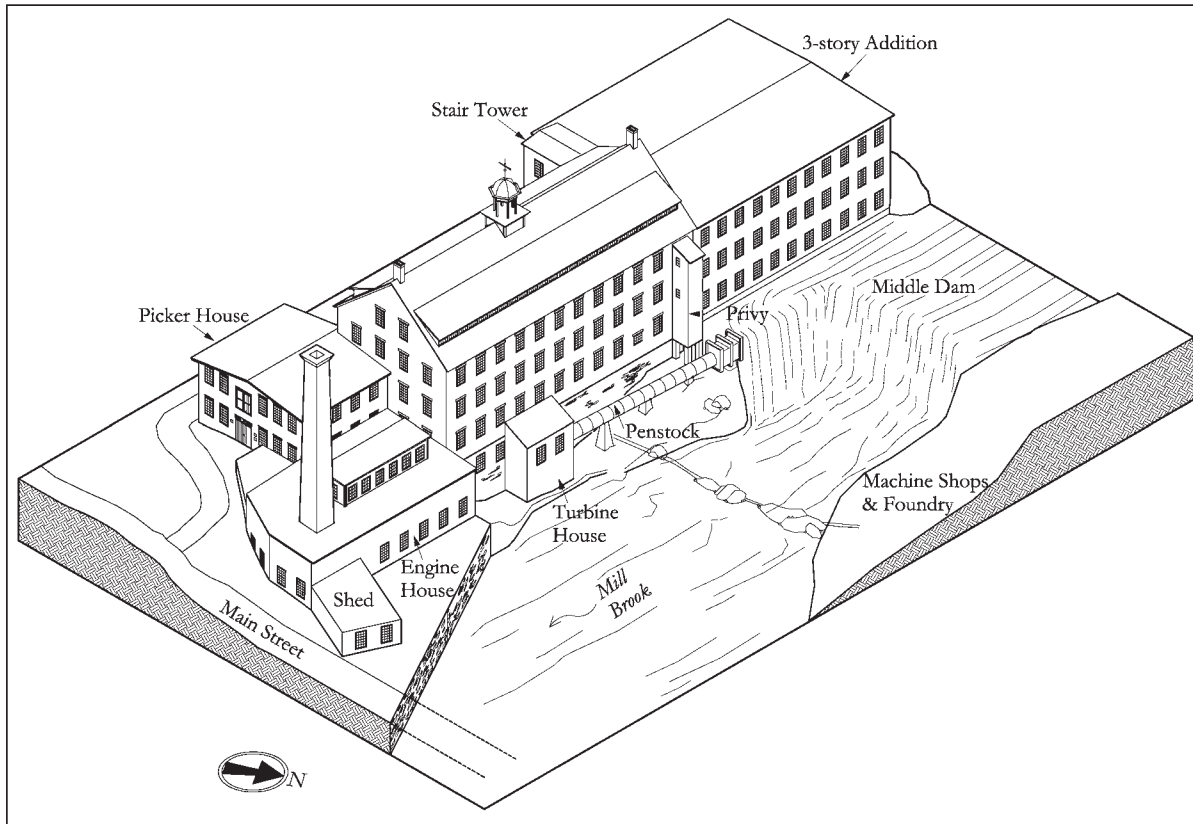
entire building showing its appearance in 1853, 1884, and today.

In 1849, to supplement the water-wheel, a power house with steam engine was added to the east elevation; a 2-story addition expanded machine tool operations on the west elevation. Robbins &

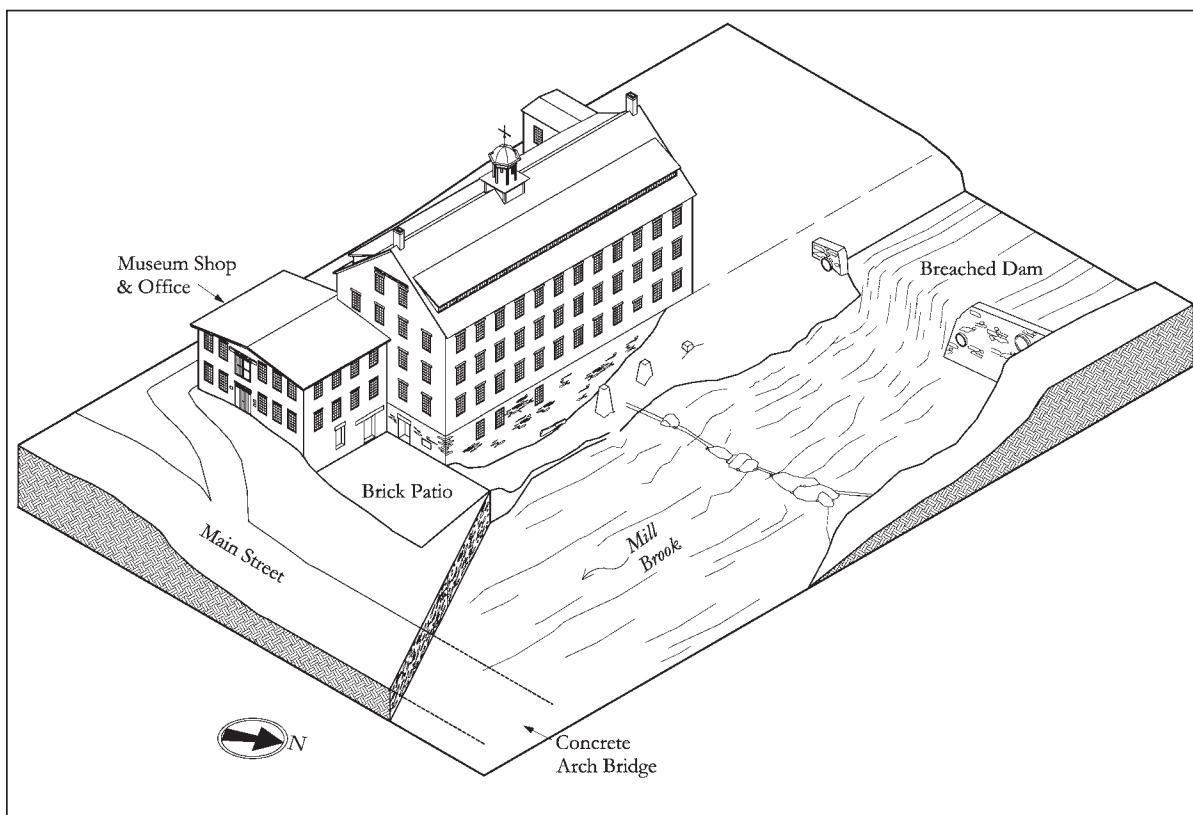
Lawrence produced world-renowned firearms for domestic and foreign contracts during this period, but ill-advisedly expanded into rail car manufacture. After the Robbins & Lawrence company failed in 1856, the building was adaptively used as a machine shop and sewing machine

factory for Windsor Manufacturing Co. (1857-1870), a cotton factory for Jones, Lamson & Co. (1870-1886), vacant (1887-1901), a steam and hydroelectric power station for the Windsor Electric Light Co. (1902-ca.1935), and a transmission

**The Waterwheel Pit** *continued on page 6*



**1884 Jones, Lamson & Co. Cotton Mill.** Expanded with third story atop weaving addition, enlarged engine house, new picker and weaving rooms, and a penstock for turbine house. Remains basically same footprint after purchase by Windsor Electric Light Co. in 1898 and Central Vermont Public Service Co. in 1926.

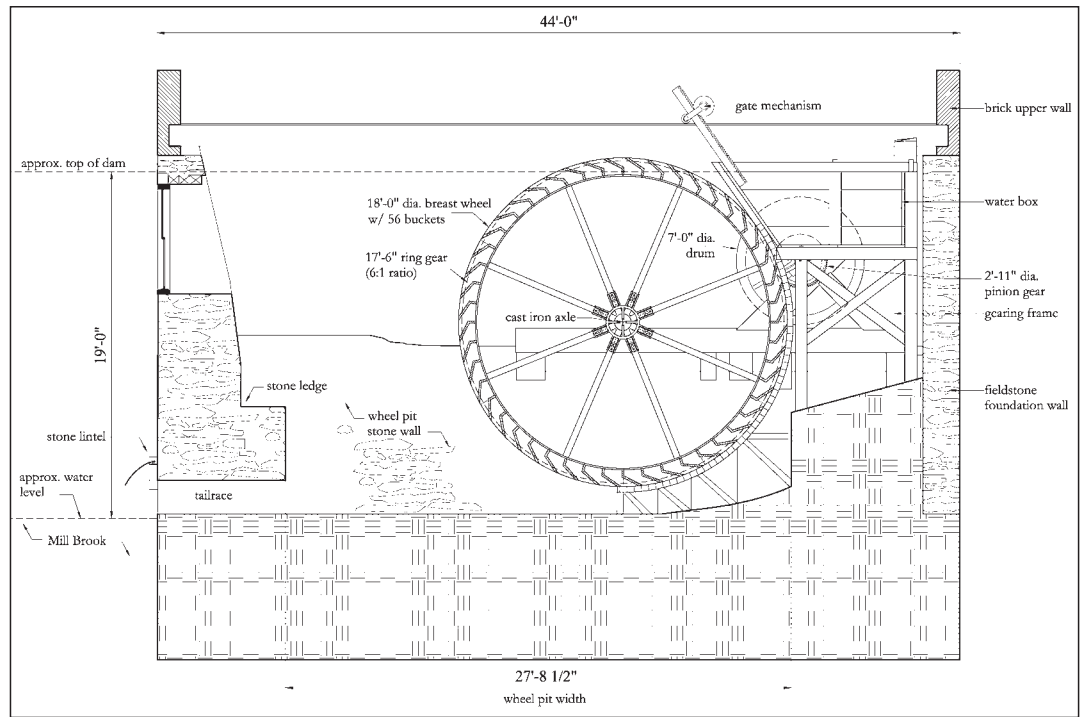


**2008 American Precision Museum.** Current layout since 1966. Manufacturing wing demolished 1950s.

**The Waterwheel Pit** *continued from page 5*

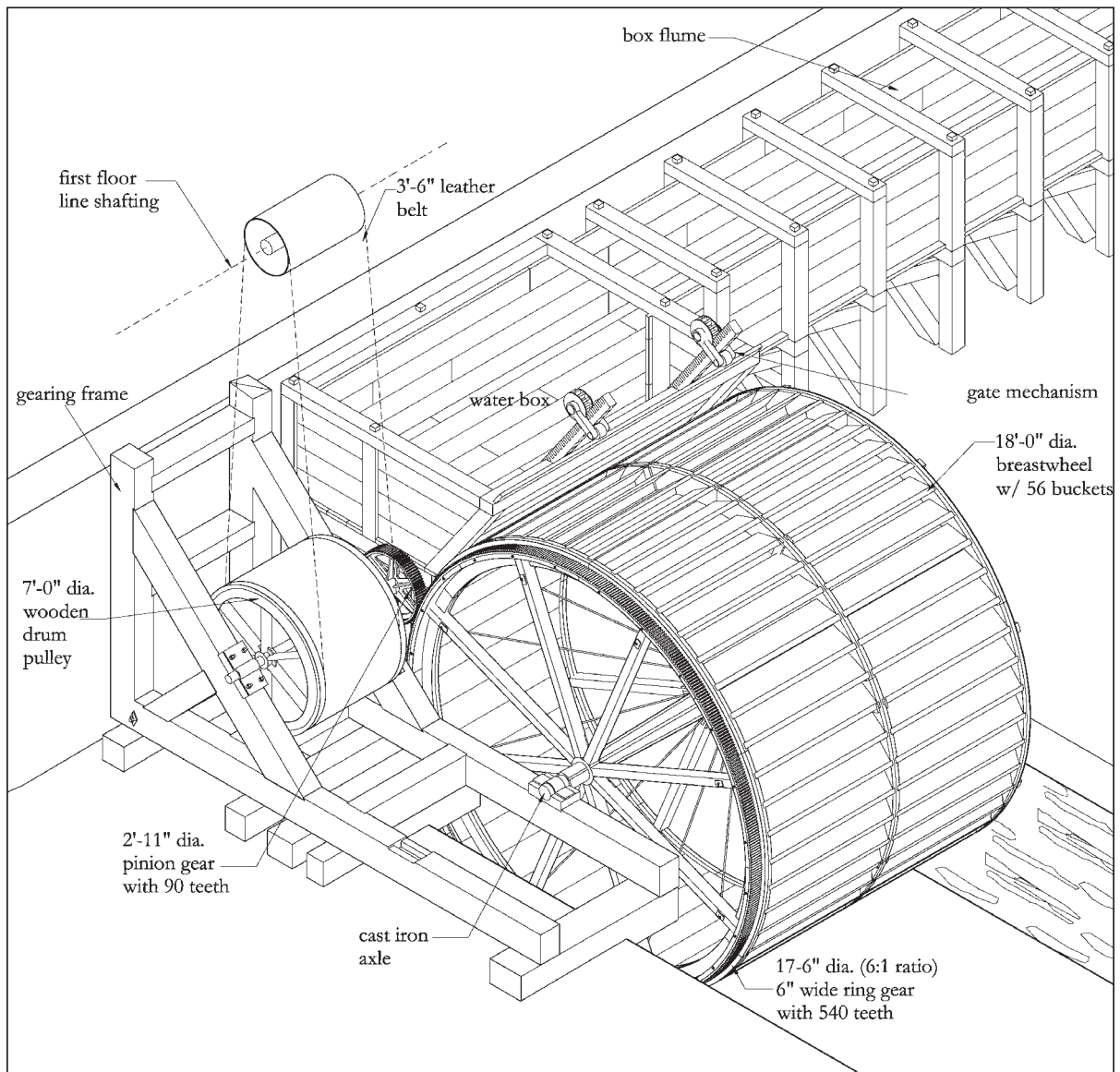
substation for Central Vermont Public Service Company (ca.1935-1965). The evolution of the power systems in the building included the original waterwheel (1846), a steam engine (1849), a turbine (1870) and electricity (1902).

The museum hopes to use this information to create a model of the waterwheel for display purposes. Selections from the study will be posted on the APM website, and we hope to publish the entire 40-page historical report illustrated with historic photographs, maps and conjectural drawings at a later date, pending funding.



**Wheel Pit Section, historic view circa 1846**

**Water Wheel Details,**  
*historic view circa 1846*





# Charlie Carter, Friend and Advisor

Charles F. Carter, Jr. was born in Ayer, Massachusetts. After graduation from Boston's Northeastern University with a degree in electrical engineering, his first job was with the Goodyear Tire and Rubber Company in Akron. In 1954, he joined the Heald Machine Company in Worcester, MA, later purchased by Cincinnati Milacron. From Worcester, he and Ruth and their growing family moved to Cincinnati, where Carter began his 30-year career with Cincinnati Milacron. When he retired in 1985 as Technical Director, his work had been focused primarily in the area of machine tool development conducting research and directing activities in metal cutting processes, machine elements and computer-aided manufacturing.

In 1985, he became Executive Director of the Institute of Advanced Manufacturing Sciences in Cincinnati, and in 1990 he joined the staff of the Association for Manufacturing Technology (AMT) as Vice President — Technology. At AMT, the trade association for machine tool

builders, he was responsible for training, quality, safety, standards, research and development. He was active on the advisory boards for the US Department of Commerce, the National Science Foundation and the National Center for Manufacturing Sciences. Carter was well known for his expertise in flexible manufacturing systems, and he wrote many papers and articles on the concept of machine utilization and the role of computer-based technologies for improving utilization.

He remained with AMT for 13 years, retiring in 2003 and was an active and involved museum trustee until his death in May 2009. He and Ruth traveled to Vermont for board meetings, always taking the time to visit family in the area. Charlie was passionate about the Machine Tool Hall of Fame, a partnership between the museum and AMT, that helped raised awareness about the museum. It is now an exhibit on the museum website.

The museum will miss his friendship, support and commitment.

*Shirley J. Grainger-Inselburg  
Board of Advisors,  
former Board of Trustees*

I met Charlie, for the first time at the American Precision Museum (APM) in 2000, while I was Acting Executive Director. At the time, he was Vice President for Technology at the prestigious Association of Manufacturing Technology (AMT). It was a significant visit in many ways, as it was to be the start of a close, long-term relationship with the museum. Not long after that, he accepted a position on the Board of Trustees and actively encouraged the museum to once again display the Machine Tool Hall of Fame exhibit and to become an active participant at AMT's bi-annual meetings in Chicago. Not only would this provide excellent exposure for the museum, but Charlie also firmly believed that members should be aware of the giants of its illustrious history.

Personally, I was thrilled to learn that AMT's Technology Issues Committee had created the Charles F. Carter, Jr. Advancing Manufacturing Award to honor academia's contributions to the advancement of manufacturing, especially related to members of AMT, shortly before his 2003 retirement. This award is now given each year to an active faculty member teaching at an accredited U.S. university and recognized by AMT as contributing to the advancement of the industry. Charlie was the first recipient of the Charles F. Carter, Jr. Advancing Manufacturing Award in 2002.

It is always at this time of the year, when I shall miss Charlie most. Along with his lovely wife Ruth, we always seemed to draw the same two hours covering the admissions table at the museum's annual Model Engineering Show held the last Saturday of October. In the quieter moments of a busy day, there was always time to catch up with each other in a relaxed setting. With Charlie's passing, APM has lost a very good friend indeed.



Charles Carter at Heald Machine Company in 1955.

# The Museum Welcomes a new Collections Manager

Beau Harris, the museum's new Collections Manager, joined the staff in July to complete the Collections Information Project (CIP). This three year initiative began in 2007 with funding from the

Institute of Museum and Library Services. Harris will continue the project to improve standards of record keeping, inventory and care of the artifact collection. The



*Beau Harris, the museum's new Collections Manager*

inventory is almost complete, and with the museum's Collections Committee, he is now working on a Collecting Plan to guide the scope of the collections over the long term. Harris will continue to work rearranging storage to promote the longevity of the collections and ease of access to them.

Harris earned a master's degree in Museum Studies from Bournemouth University in England. Before coming to the American Precision Museum, he was the Registrar at the Fairbanks Museum & Planetarium in St. Johnsbury, VT, and then with the Maine Historical Society in Portland, working on an inventory project.

Along with a strong background in collections care, he brings a knowledge of woodworking and an interest in exhibit development. He also plays the drum with the Hanaford's Volunteers Fife and Drum Corps.

## A Museum Wedding

The season opened a few weeks early this year when Ethan Guth and Robin Collins were joined in marriage by Windsor resident and Justice of the Peace, Bill Ballantyne.



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