REACTION-TYPE HYDRAULIC TURBINE CA. 1850 PLANE 9 WEST, MORRIS CANAL

A NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK

Stewartsville, New Jersey
June 2, 1979

The American Society of Mechanical Engineers

DEDICATION CEREMONY

National Historic Mechanical Engineering Landmark

Reaction-Type Hydraulic Turbine, Plane No. 9 West

The Morris Canal, Stewartsville, N.J.

10:00 AM, June 2, 1979

PROGRAM

Welcome	*Peter S. Rosoff , Vice President, ASME Region II*
Introduction of Honored Guests	*Arthur W. Ebeling, In coming-chairman, Anthracite-Lehigh Valley Section* *William Golden, Chairman, ASME North Jersey Section*
ASME Landmark Program	*J.J. Ermenc, Chairman, ASME National History & Heritage Committee*
History of Reaction-Type Turbine at Plane No. 9	*James Lee*
Presentation of Plaque	*O.L. Lewis, President, The American Society of Mechanical Engineers*
Acceptance of Plaque	*James Lee*
Closing Remarks	*Peter S. Rosoff*

A tour of the grounds, Turbine and canal museum will begin immediately following the ceremony.

Wording Which Appears on the Bronze Plaque

NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK
REACTION-TYPE HYDRAULIC TURBINE ca 1850
Plane 9 West, Morris Canal

The inclined planes of the Morris Canal were powered by large reaction turbines, nearly 14 feet in diameter, geared to the winding drums that hauled the canal boats between levels. This example was restored to view in 1972 after 48 years of burial in-place.

The reaction or "Scotch" turbine had as its antecedent the steam reaction wheel invented in Greek Alexandria by Hero around 100 B.C. Its hydraulic application on a practical basis in the United States began early in the 19th century. After mid-century, French-inspired turbine design pushed these machines into obsolescence.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS - 1979

THE MORRIS CANAL: A BRIEF HISTORY

"In the summer of 1820, George P. McCulloch, President of the Morris County Agricultural Society, hung a "Gone Fishing" sign on his office door and took himself off to Great Pond (now known as lake Hopatcong). While casting on the waters of this beautiful lake, set in the heart of the New Jersey Highlands, McCullough reflected, as do all good fishermen, on a number of weighty subjects. Among them was the diminishing output of the local iron industry, the bountiful crops that could be raised if only there was a reliable way of getting them to market in Paterson or Newark, and perhaps above all, the general deplorable condition of the roads. Then with the swiftness of bass leaping to the bait an idea came to him that could help to solve all of these problems -- a canal.

"With a fine American disregard for obstacles, such as the Highlands, the Appalachian range, and the Kittatiny mountains, McCullough envisioned a canal linking the coal-rich Pennsylvania Lehigh Valley with the manufacturing towns of eastern New Jersey and New York. It would originate from Great Pond itself, helped by damming the Musconetcong River to form a reservoir, and then proceed westward to the Delaware River and eastward to the Passaic River.

"The terrain over which much of the canal was to flow was formed when the last great ice mass, known as the Wisconsin Glacier, crept down from the North about 15,000 years ago and reached into what are now Union and Morris counties. Then as the earth gradually turned warmer, the glacier slowly retreated, leaving behind a wide band of rock and debris known as a terminal moraine.... This moraine, which stretches in a counter grain band across the State, is an assortment of kettles and kames (hollows and hills) that was known to the Colonists as the short hills.

"The ditch was dug by hand, all 102 miles of it, mainly by immigrant Irishmen. They knew nothing of Pleistocene Eras, glaciers, or moraines, they only knew that the rocks and stones they were uncovering, shifting and hauling out of ditches, groaning over, sweating over, and breaking their backs over, were of such size and

orneriness that 'Sure'n it must have been the Devil himself who put them there.' But nevertheless they shoveled across the northern hills of New Jersey, through forests, through swamps, pick-axing their way through bedrock and slag, through mud and mire, all for a dollar a day. . . They tore across the land with incredible speed and fury, perhaps sensing somehow that they were a part of that great thrust westward; poor laborers though they might be they were fulfilling a destiny. They were changing the face of America."

The above description of the Canal's beginnings appeared in an article in New Jersey Outdoors, September/October, 1978 issue, by Eileen M. Van Kirk. In the preface to The Morris Canal: A Photographic History, James Lee tells this about the early days:

"In 1822 George P. McCulloch, a Morristown businessman, brought a group of interested citizens together at Morristown, including Governor Isaac Williamson, to discuss his idea with them. His proposal was received favorably. On November 15, 1822, an act was passed by the New Jersey legislature appointing canal commissioners, one of which was McCulloch, to employ technical help to investigate the feasibility of a canal, possible route location, and estimate costs. The State appropriated two thousand dollars for this study. Ephraim Beach, a well known canal engineer, became the engineer to the commission, and James Renwick, Professor of Natural and Experimental Philosophy at Columbia University, was retained as consultant.

"McCulloch's estimate of the summit level was 185 feet above tide at Newark and 115 feet above the Delaware River. When Professor Renwick completed the first rough surveys, he determined that the summit level would be 454 feet above mean tide at Newark. After the final survey was completed the summit level was found to be 914 feet above mean tide at Newark and 760 feet above low water in the Delaware River at Phillipsburg.

"The State of New Jersey did not build the canal. This was accomplished by private investors. An act was passed on December 31, 1824, incorporating the Morris

Canal and Banking Company to form an artificial waterway capable of navigation between the Passaic and Delaware rivers. Twenty thousand shares of stock at one hundred dollars a share provided two million dollars of capital -- one million for building the canal and one million for banking privileges. One of the provisions of the charter was that the State could take over the canal at the end of ninety-nine years. If the State did not desire to take over the canal, the charter remained in effect for fifty more years, after which the canal became the property of the State without cost. Banking privileges were to remain in effect for thirty-one years. However, these were dropped when the company reorganized in 1844.

"Stock subscription books were opened in the spring of 1825. By September of that year thirty miles were under contract with seven hundred men engaged in digging the canal bed. Construction of the locks and inclined planes began later. In 1826 eleven hundred men worked on the canal. Construction was divided into sections which were contracted for separately. In 1827 work began at lake Hopatcong, or Great Pond as it was known then. This pond was raised five feet by a new dam located just above the old forge dam of the Brooklyn Forge built by Garret Rapalje, about 1750.

"As different sections of the canal were completed, they were opened up for local use. On November 4, 1831, the first trip from Newark to Phillipsburg was completed. The canal was 90 miles long; and, the trip from Newark to Phillipsburg took about five days. The first full boating season was 1832.

"The estimated cost of the canal was $817,000.00. When it was completed to Newark in 1831, the actual cost was $2.104,413.00. In 1836 the eleven and three quarter mile extension to Jersey City was added. The main line of the canal was then 102.15 miles long. If you include all of the waters controlled by the canal company that were navigable -- the additional 4.26 miles to the Pompton feeder lock, 1.76 miles to the Pompton Iron Works, .67 miles to the Lake Hopatcong feeder, and .42 miles on the little and big basin at Jersey City -- you would have a grand total of 109.26 miles. This was the mileage in 1845. Within this distance there were 23

inclined planes and 34 locks consisting of feeder, outlet, tide, guard, and lift locks.

"In spite of accidents on the early planes and the company's lack of profits and shortage of money to maintain and operate the canal, the adjacent territory was deriving considerable benefit even at this early period. Real estate values boomed. Manufacturers were enjoying a wider market for their products.

"The canal originally was built for boats of ten gross tons; gradually this was increased to twenty-five tons. Section boats were introduced in 1845 and carried cargoes of forty-four tons. After an enlargement program was completed in 1860, boats carrying seventy gross tons and more were common. This enlargement program of the canal cost $1,700,000.00, making the total cost of the completed canal $5,100,000.00.

"The tonnage on the canal steadily increased from 58,259 tons in 1845 to 899,220 tons in 1866. From 1855 on, coal was the main commodity carried on the canal. However, grain, wood, cider, vinegar, beer, whiskey, bricks, hay, hides, iron ore, sugar, lumber, manure, lime, and many other goods also were transported. The decade of 1860 to 1870 was the only prosperous period in the history of the canal, a period which embraced the Civil War, at which time all transportation facilities were taxed to their fullest capacity, and witnessed the greatest growth in population and industry of the territory served by the canal.

"However, the canal company was not able to relax and enjoy the position of financial stability expected by its directors and investors. The railroads were continuously encroaching on the canal company's business. The Morris Canal did receive for eastbound shipment a considerable tonnage of coal at Washington, New Jersey, from the Delaware, Lackawanna, and Western Railroad between the years 1856 and 1870. This reached a maximum of 146,359 tons during the year 1867 but dropped to 80,977 tons in 1868 and completely disappeared after 1870 when all coal was shipped on the Morris and Essex Railroad, leased to the Delaware, Lackawanna, and Western in 1868. This loss amounted to about 34.4% of the entire coal business transacted by the Morris Canal at that time.

"In 1865 the Ogden Mine Railroad was built to carry iron ore from Jefferson Township to Nolan's Point on lake Hopatcong, a distance of ten miles. This ore was transferred to canalboats which were towed by a steam tug across the lake to "Brooklyn" lock. The boats went through the feeder to the main canal and then east or west, depending upon the individual bills of lading. The company derived at least 50,000 to 60,000 tons of ore freight a year from this business. In 1880 the tonnage was 108,000 tons. With a boat normally carrying seventy tons, 1,543 boat loads were needed to move this cargo. This business was lost when the Central Railroad of New Jersey took over the Ogden Mine Railroad and connected it to the Central's High Bridge Branch in 1881.

"The coal and iron ore losses were major ones. Coupled with many smaller losses over the years, the company's financial position had one place to go -- down. On December 20, 1870, the New Jersey legislature passed a supplement to the Morris Canal and Banking Company's charter allowing the company to lease its property. The Lehigh Valley Railroad leased the Morris Canal properties in 1871 for a period of ninety-nine years.

"The Lehigh Valley Railroad guaranteed dividends on the stock at the rate of seven percent a year, almost as much as had been earned in the best year of canal operation. The canal never made a profit for its new owners. Tonnage and tolls declined steadily. As time went on, it became apparent to most everyone that the canal had outlived its usefulness.

"On March 31, 1903, the legislature passed a resolution to investigate and report as to whether legislation should be passed permitting the abondonment of the canal. This commission reported that the canal no longer had any economic justification and recommended that it be abandoned. A plan of abandonment was sent to the legislature in 1905; nothing happened. In 1912 another commission was appointed. It reported in favor of abandonment; but, again the legislature failed to act.

"In February 1918 the Morris Canal and Banking Company and the Lehigh Valley Railroad filed a bill in the Court of Chancery against the North Jersey District Water Supply Commission to stop them from building the Wanaque Reservoir, needed for

supplying Newark and other nearby cities with water. The canal company contended that water diverted from the Wanaque and Pompton Rivers would render it impossible to operate the canal. The canal company won its case, which led to the final and successful effort to abandon the canal.

"On March 12, 1922, the legislature approved an act creating a commission empowered to make terms of settlement with the canal company with a view toward securing the transfer of the Morris Canal to the State. On November 29, 1922, the Morris Canal passed into the hands of the State of New Jersey, with the exception of the property within the town limits of Phillipsburg and Jersey City (save the Little Basin).

"In 1924 a bill provided that the Morris Canal and Banking Company continue as a corporation holding the property as trustee for the State, that members of the Board of Conservation and Development be made Directors of the Corporation, that operation of the canal be ended, that Lake Hopatcong, Lake Musconetcong, Cranberry Lake, Bear Pond, Saxton Falls, and Greenwood Lake be retained for public use, and that remaining property be sold. This has been done well and faithfully over the years. On December 31, 1974, the charter [ceased] to be in effect. . . [and] the remaining properties [reverted] to the State of New Jersey for all time."

THE INCLINED PLANES

It has been said that the Morris Canal probably would not have been built if the inclined plane -- the most remarkable feature of the Canal -- had not been used. The planes saved both time and water over the conventional locks used so widely on other canals. Devised by James Renwick, Professor of Natural and Experimental Philosophy at Columbia University, these planes were based on a similar method used in England.

Alvin F. Harlow, in Old Towpaths, described their significance this way:

"The Morris was one of the engineering wonders of America. It was the highest climber of all the old canals. Within the distance of 51 miles from tidewater at Newark Bay to the summit level at the tip of Lake Hopatcong the channel climbed 914 feet. Thence it dropped again, 760 feet to the Delaware River at Phillipsburg, opposite Easton -- a total rise and fall of 1674 feet in a trifle over 90 miles. Had locks, with the limited lift of those days, been depended upon for all this, between two and three hundred of them would have been required. This would have been prohibitive.

"James Renwick, the English engineer who supervised the building of the canal, overcame the difficulty in a spectacular way by building twenty-three inclined planes which took care of the greater part of the grade. Only twenty-three locks were needed to cover the rest.

"Wherever there was a long steep hill to be surmounted, the canal breasted it boldly, and instead of a series of locks, ascended it by means of one of these inclines, the passage of which consumed but little more time than the passage of a lock. The planes were in reality boat railways. Their usual ascent was somewhere near ten feet for every hundred feet of track. The average lift of the planes was about 63 feet; but the longest one surmounted a grade of 80 feet."

Renwick developed the gearing for the original planes when they were powered by a 30-foot overshot waterwheel in 1831. This same gearing was used when the turbine was

installed after the canal was enlarged. At this time the boats' carrying capacity was increased from 44 tons to 75 tons.

Plane No. 9 West was the highest and longest plane on the Canal --it had a double set of tracks. It was 1,510 feet long to its summit and 1,788 feet long from end to end.

The efficiency of the planes was first demonstrated in 1826 at a plane near Rockaway which rose to an elevation of 51 feet. Without the plane it would have taken five locks to raise the canal to the proper level, and a boat would have spent at least an hour going through them. With the plane, each trip up or down took approximately eight minutes.

PLANE NO. 9 WEST

Plane No. 9 West at Port Warren was the longest and highest inclined plane on the Morris Canal. In those bygone days when boats still plied the waters of the Morris, plane cars at Port Warren carried boats over an incline sixteen hundred feet long to surmount a difference in elevation of one hundred feet. The three-tiered plane house, from which the plane tender in his turret at the top could see for miles across the rolling Phillipsburg hills into Pennsylvania, must have stood like a solitary castle among the surrounding fields and pastures.

Like the other twenty-two inclined planes on the Morris Canal, this one ran on water power. Water from the upper level of the canal was led through a wooden flume to a vertical cast-iron pipe -- the penstock -- where it dropped, traveled around a "J" at the bottom, and was forced back up underneath a huge iron wheel with four jets. This was the Scotch reaction turbine, housed in a vaulted stone chamber deep underground. As the water surged through the turbine and out the four jets, the turbine revolved, and, through an arrangement of shafts, gears, wheels, and cable, the mechanical energy generated at the turbine was utilized to transport canal boats in the hinged plane cars over the incline.

There must have been times in the nineteenth century when that Scotch turbine at Port Warren ran almost constantly, as coal traveled east from Pennsylvania. But the traffic on the canal declined rapidly after the Civil War, and, as the years passed, the turbine was called upon to do its job less and less frequently. By the 1920s, the ancient turbine was still.

Then came the workmen, tearing down the bridges, filling in the canal bed. The plane house was razed, and the chamber below it was filled in. Tons of rock and soil were heaped on the Scotch turbine at Port Warren, sealing it in its grave.

James Lee came to Plane 9 West in 1947 to raise his family in the old plane

Jim Lee guides a load of debris out of the turbine chamber as the excavation proceeds

tender's house, still standing. Having been interested in canals since his childhood days, when he had heard old-timers in Phillipsburg talking about their lives on the Morris and the Lehigh, Mr. Lee set about restoring the plane tender's house and preserving the other remaining relics of the Morris Canal on his property. He noted that the cast-iron penstock was still there -- albeit filled in -- and he reasoned that, if it hadn't gone for scrap during the war, then the turbine, which was much harder to get to, must still be there too.

For years, the theory couldn't be tested, for it required heavy equipment, many strong backs, and a lot of concerted dedication to dig out the boulder-filled chamber where the turbine hopefully lay buried. In July, 1972, work began in earnest. Lee's neighbor, twenty-seven-year-old Scott Hamlen, had become interested in the canal, and now he too was anxious to see whether or not the old Scotch turbine was still there. By the end of the month Lee, Scott, two of Lee's sons, and a number of part-time volunteers who had heard about the project were busy hauling boulders out of the vaulted stone chamber.

Then, on the night of August 6, the work crew reached the turbine, some twenty-four feet down. It had been somewhat damaged by the tons of debris that had fallen on it, but was still in remarkably good shape, considering the circumstances.

The chamber of carefully fitted stones begins at the ground surface, on the top of a knoll, and drops underground as a sixteen-by-five-foot rectangular opening; between depths of about eighteen feet and twenty-three feet the opening enlarges to a vaulted room, nearly hemispherical in shape, and drops another six feet to the floor. The turbine sits at the center of this hemisphere-capped circular chamber, nearly covering all the floor area. An arched tunnel leads out from this room, running slightly downhill, and emerges at the ground surface in the middle of a field a good distance below the site of the plane house foundation. This was the tail race, which carried the water from the turbine out to the level below.

The turbine can be viewed through a grating at the ground surface twenty-nine feet above the floor of the stone chamber. It can also be seen by traveling through the underground tail race.

The reaction-type or Scotch turbine at Plane No. 9 West was installed during the winter of 1851-52. It is considered a masterpiece of mechanical engineering and stands as a witness to the engineering practices of the early to mid-1800s. Very few reaction turbines have survived to the present day.

ABOUT JAMES LEE

Over forty years ago, James Lee began his obsession with the Morris Canal. It persists today in his extensive collection of photographs, documents and artifacts relating to the canal's history, his restoration work on the plane tender's house, power house and turbine area of Plane 9 West, his tape recordings of and notes on conversations with canal employees, and his many appearances before civic groups and on public television to talk about the Canal.

Since he was a boy, his fascination for the Canal has never waned. As a child, Lee rafted in the basin of the Canal at Port Delaware (Phillipsburg, New Jersey). As a young man, he and his wife, Mary, bought one of the old plane tender's houses -- determined not to let the Morris Canal slip from memory.

Initially the house was restored. Next, after years of labor, the turbine and other portions of the inclined plane were uncovered and preserved. A small collection of Morris Canal memorabilia has grown into a major private museum which attracts thousands of visitors each year.

Lee clearly demonstrates that one dedicated individual can preserve an important segment of history so future generations can grow to understand and appreciate it.

Said Lee about the Canal:

"When I was but a boy, I remember building a raft and using it in the Morris Canal basin at Port Delaware. My raft could hold two small boys quite well; and, a friend and I poled it back and forth over a half-mile section of the Canal.

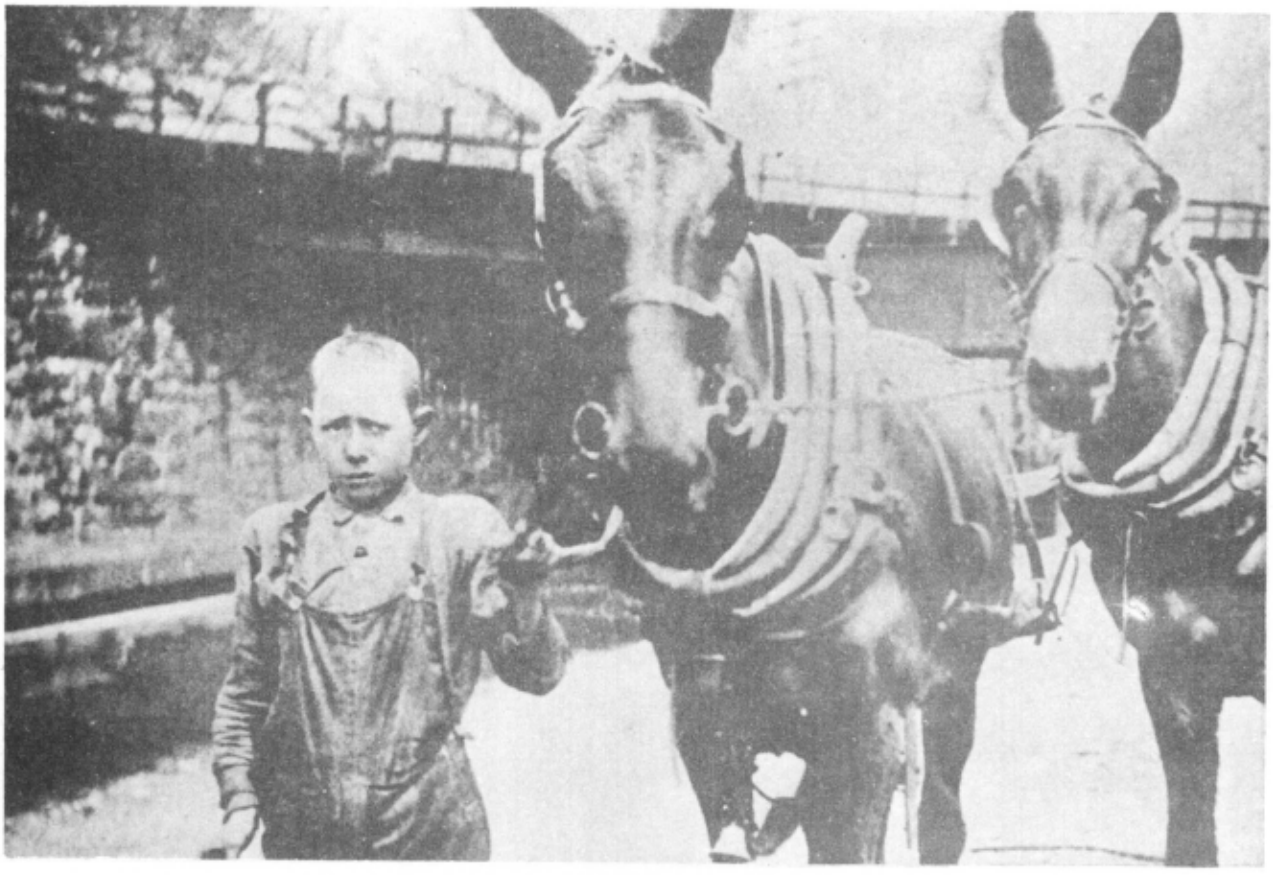
"I remember entering the little office of H. T. Spinner, for many years the agent of the Morris Canal Company at Port Delaware, and finding the floor littered with papers pertaining to shipping on the Morris Canal, If only I had had the foresight to pick up some of them -- how priceless they would be today.

"I remember listening to men, many older than my father, tell me stories about life on the Morris Canal and describe a pace of living far less hectic than that of the 1970s.

"There have been some who said that the Canal was a blue scar across the northern waist of New Jersey. I think, however, that the Morris Canal was a beauty mark, where men could work and boys and girls could play; a place where a Sunday walk on the towpath was sheer contentment; a place where there were more fish than fishermen; and an engineering wonder that brought visitors from all over the world who stood, marveled at it and admired it.

"The Morris Canal is gone forever. Never again will the sound of the boatmen's conch shell horn echo and re-echo in the valleys and throughout the mountains of New Jersey."

(1)



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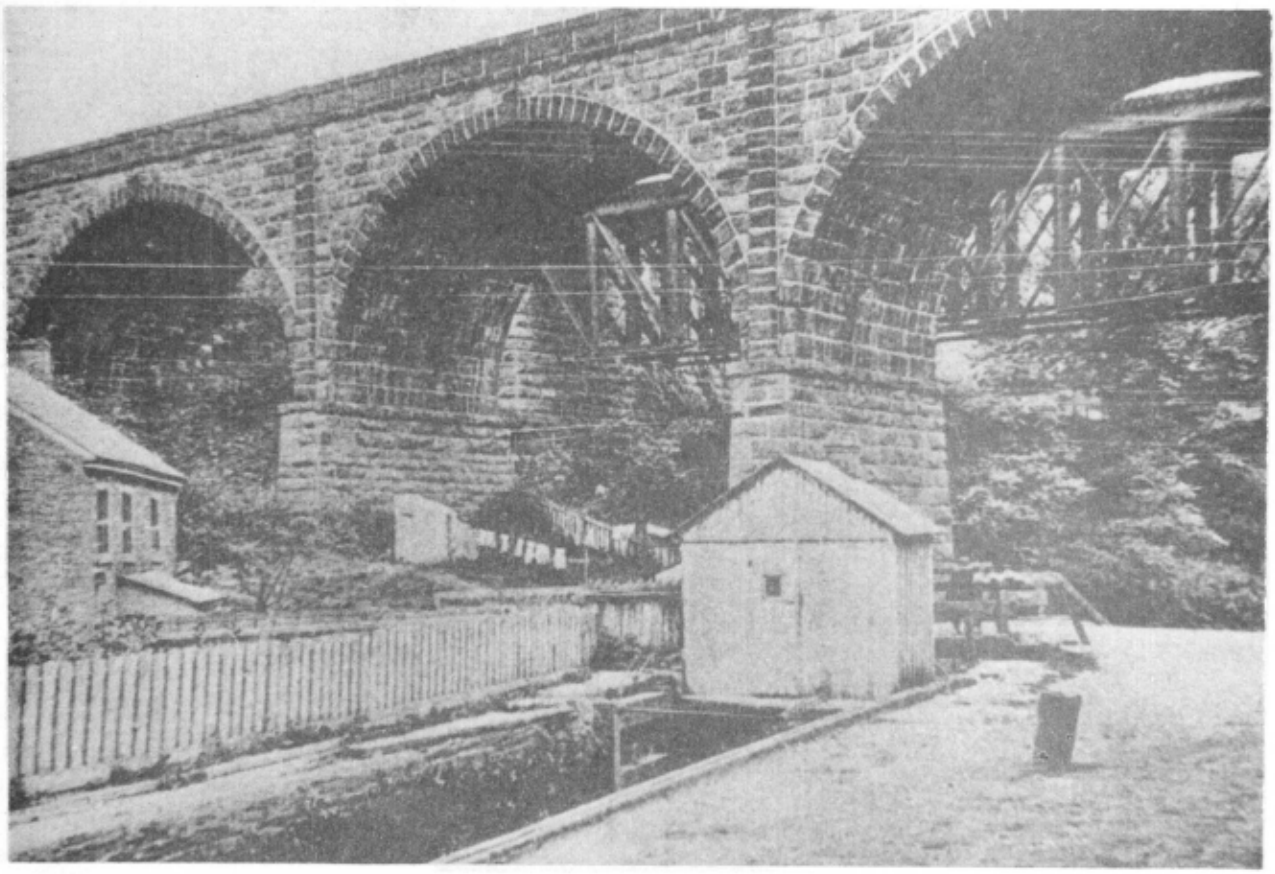

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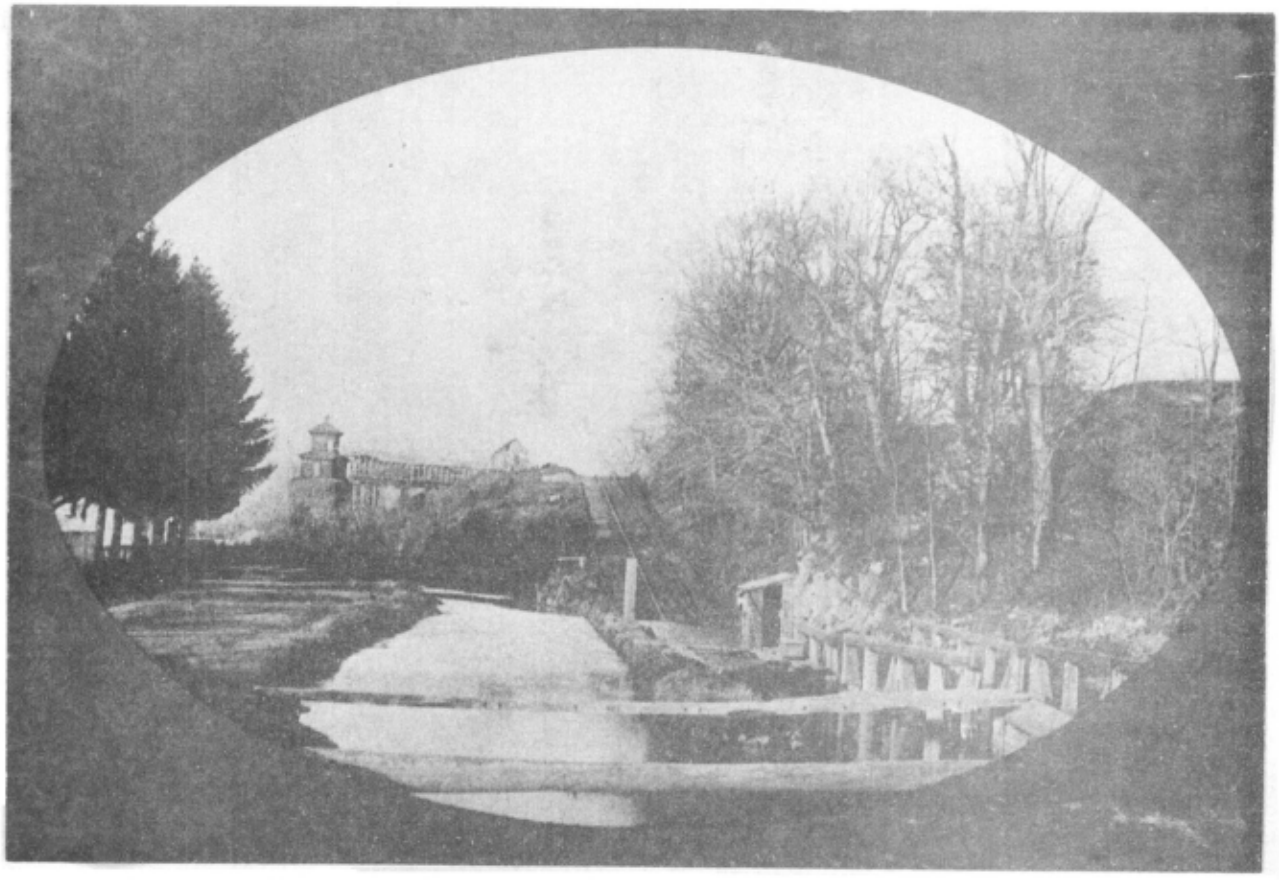

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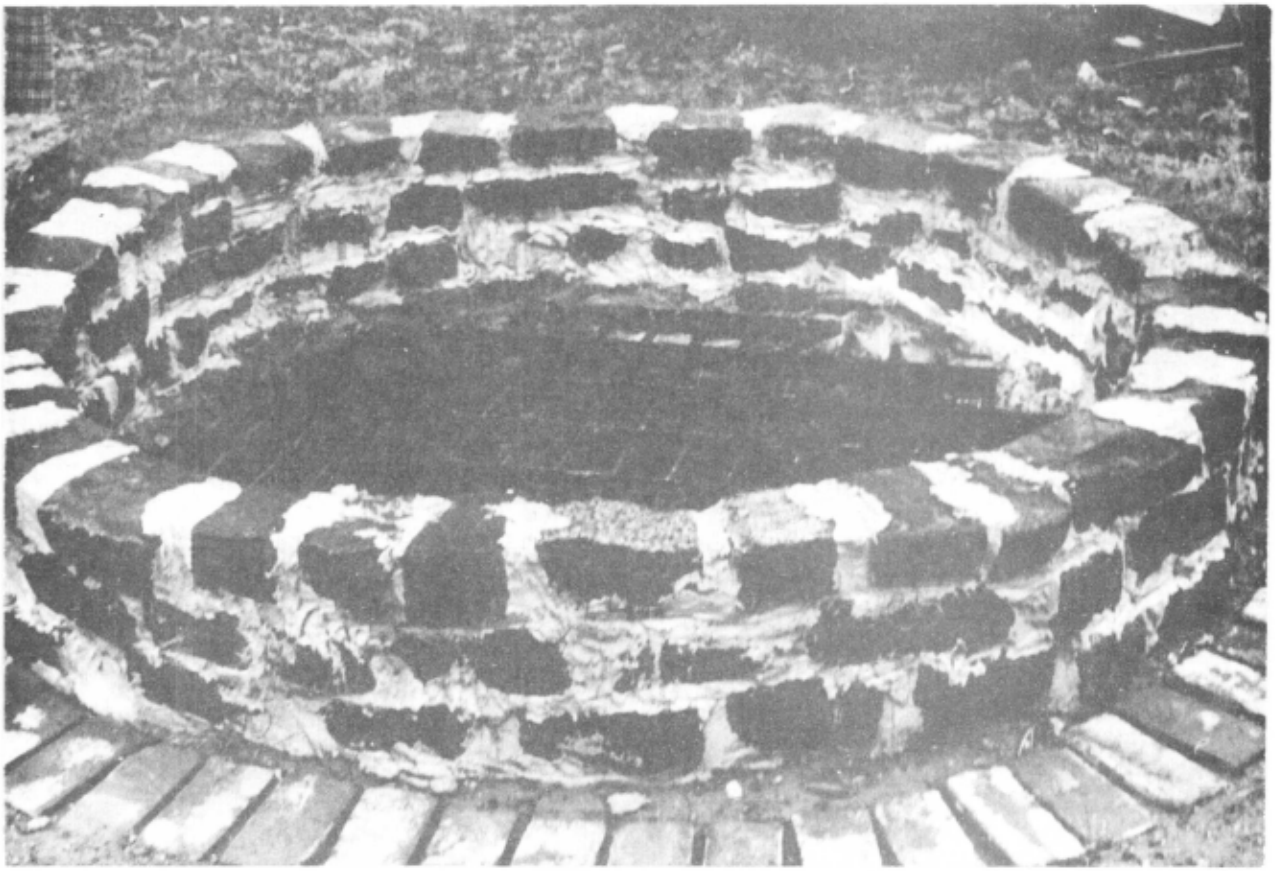

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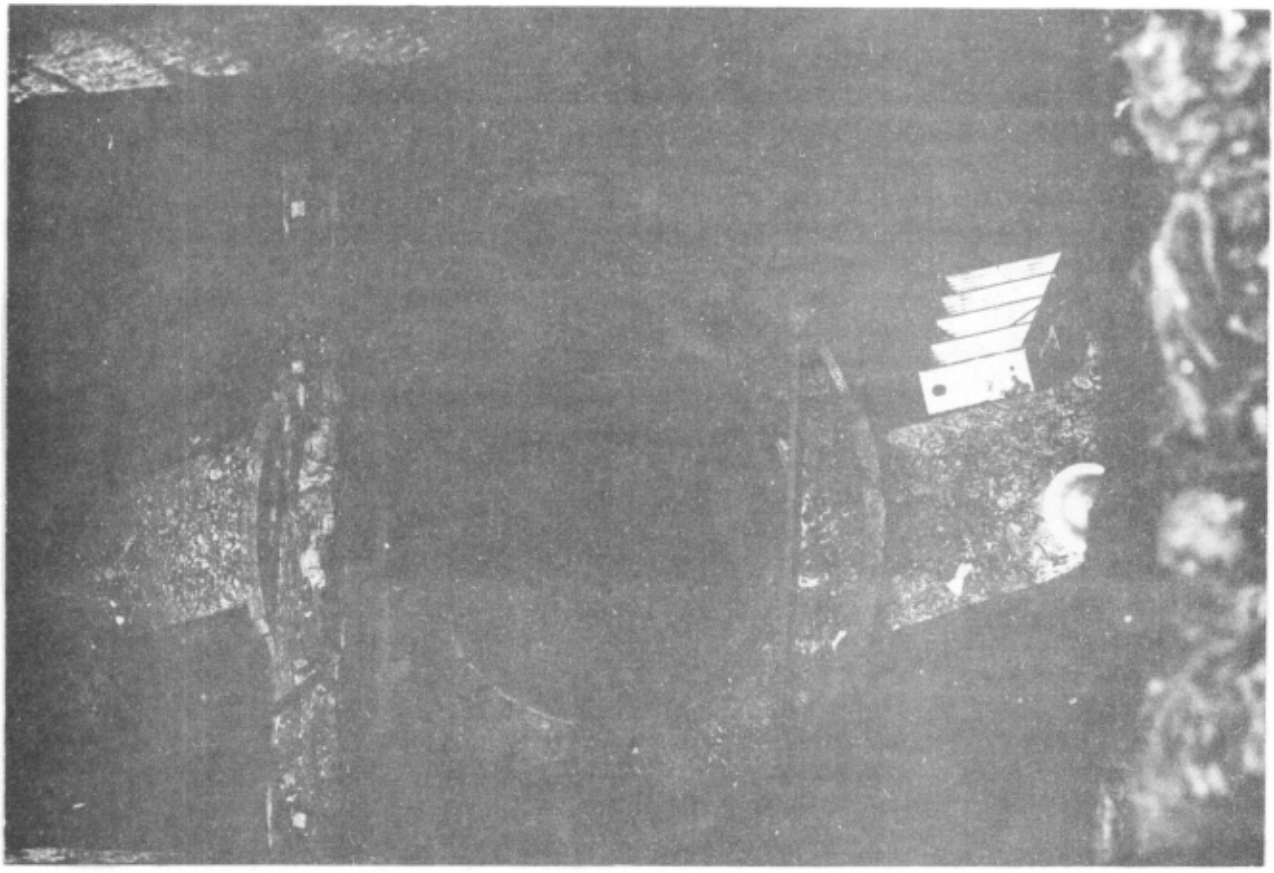

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PHOTO CAPTIONS

1. *Three boats at Green's Bridge, Phillipsburg, New Jersey. Tied up Sunday, April 23, 1899.*

2. *The motive power for the canal boats, two mules and a boy.*

3. *Lock NO. 10 West near the stone arches of the Central Railroad of New Jersey Bridge, Phillipsburg, New Jersey. Rise in elevation 9 feet.*

4. *Plane No. 10 West near Phillipsburg. Rise in elevation 44 feet.*

5. *Penstock opening at Plane No. 9 West, Port Warren, near Stewartsville, New Jersey.*

6. *Remains of Barker Reaction Turbine in wheel chamber at Plane No. 9 West, Port Warren, Stewartsville, New Jersey.*

7. *Brow of double-tracked inclined Plane No. 9 West, looking east.*

8. *Remains of Plane No. 9 West looking west. Rise in elevation 100 feet.*

ACKNOWLEDGMENTS

The North Jersey and the Anthracite-Lehigh Valley Sections of The American Society of Mechanical Engineers gratefully acknowledge the efforts of all who cooperated on the landmark dedication of the Reaction-Type Hydraulic Turbine, Plane No. 9 West, The Morris Canal.

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PLANE NO. 9 WEST, THE MORRIS CANAL

Mr. and Mrs. James Lee, and Family

THE BROCHURE

The brochure was edited by Carron Garvin-Donohue, ASME Public Relations staff, based on material which appeared in the following publications: The Morris Canal, James Lee; Tales the Boatmen Told, James Lee; "In Search of the Morris Canal," N.J. Outdoors, Sept./Oct. 1978, Eileen M. Van Kirk; Old Towpaths, Alvin F. Harlow; and "An Archeological Discovery in Warren County," Canal Society of New Jersey. The old photographs in this brochure were reproduced from The Morris Canal: A Photographic History, by Mr. Lee; the others were taken by Bruce Ross, also a member of the ASME Public Relations Staff.

NATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK PROGRAM

In September 1971 the ASME Council reactivated the Society's History and Heritage program with the formation of a National History and Heritage Committee. The overall objective of the Committee is to promote a general awareness of our technological heritage among both engineers and the general public. A charge given the Committee is to gather data on all works and artifacts with a mechanical engineering connection which are historically significant to the profession --- an ambitious goal, and one achieved largely through the volunteer efforts of the Section and Division History and Heritage Committees and interested ASME members.

Accordingly, two major programs are carried out by the Sections and Divisions, under the direction of the National Committee: 1) a listing of industrial operations and related mechanical engineering artifacts in local Historic Engineering Records; and 2) a National Historic Mechanical Engineering Landmark program. The former is a record of detailed studies of sites in each local area; the latter is a demarcation of local sites which are of national significance --- people or events which have contributed to the general development of civilization.

In addition, the Society cooperates with the Smithsonian Institution in a joint project which provides contributions of historical material to the National Museum of History and Technology in Washington, D.C. The Institution's permanent exhibition of mechanical engineering memorabilia is under the direction of a curator, who also serves an an ex-officio member of the ASME National History and Heritage Committee.

The Reaction-Type Hydraulic Turbine, Plane No. 9 West, Morris Canal is the thirty-sixth landmark to be designated since the program began in 1973. The others are:

Ferries and Cliff House Cable Railway Power House, San Francisco, CA
Leavitt Pumping Engine, Chestnut Hill Pumping Station, Brookline, MA
A.B. Wood Low-Head High-Volume Screw Pump, New Orleans, LA
Portsmouth-Kittery Naval Shipbuilding Activity, Portsmouth, NH
102-inch Boyden Hydraulic Turbines, Cohoes, NY
5000 KW Vertical Curtis Steam Turbine-Generator, Schenectady, NY
Saugus Iron Works, Saugus, MA
Pioneer Oil Refinery, Newhall, CA
Chesapeake & Delaware Canal, Scoop Wheel and Engines, Chesapeake City, MD
U.S.S. Texas, Reciprocating Steam Engines, Houston, TX
Childs-Irving Hydro Plant, Irving, AZ
Hanford B-Nuclear Reactor, Hanford, WA
Manitou and Pike's Peak Cog Railway, Colorado Springs, CO
Edgar Steam-Electric Station, Weymouth, MA
Mt. Washington Cog Railway, Mt. Washington,NH
Folsom Power House #1, Folsom, CA
Crawler Transporters of Launch Complex 39, J.F.K. Space Center, FL
Fairmount Water Works, Philadelphia, PA
U.S.S. Olympia, Vertical Reciprocating Steam Engines, Philadelphia, PA
5 Ton "Pit-Cast" Jib Crane, Birmingham, AL
State Line Generating Unit #1, Hammond, IN
Pratt Institute Power Generating Plant, Brooklyn, NY
Monongahela Incline, Pittsburgh, PA
Duquesne Incline, Pittsburgh, PA
Great Falls Raceway and Power System, Patterson, NJ
Vulcan Street Power Plant, Appleton, WI
Wilkinson Mill, Pawtucket, RI
New York City Subway System, New York, NY
Baltimore & Ohio Railroad, Baltimore, MD
Ringwood Manor Iron Complex, Ringwood, NJ
Joshua Hendy Iron Works, Sunnyvale, CA
Hacienda La Esperanza Sugar Mill Steam Engine, Manati, PR
RL-10 Liquid-Hydrogen Rocket Engine, W.Palm Beach, FL
A.O. Smith Automated Chasis Frame Factory, Milwaukee, WI