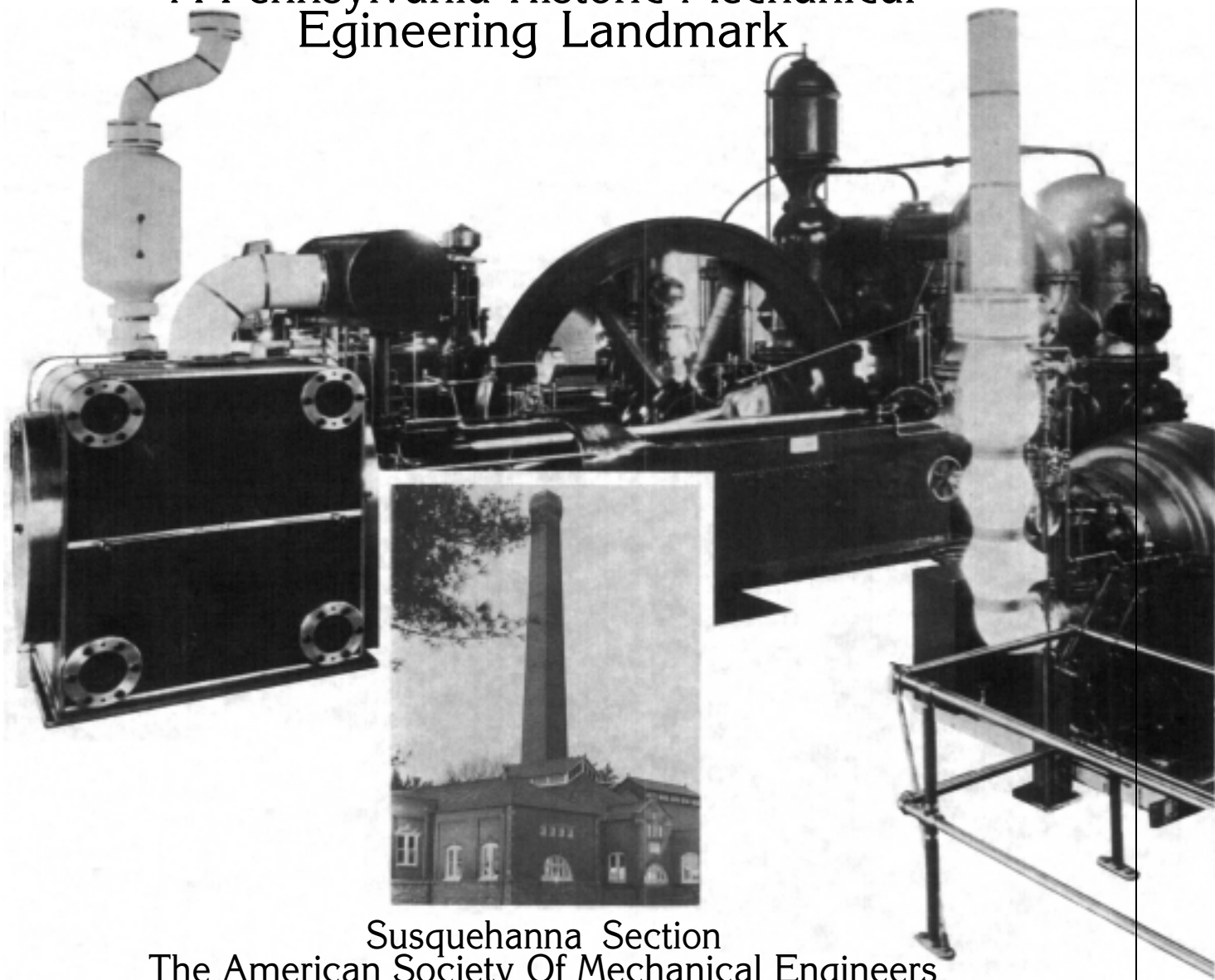


WORTHINGTON HORIZONTAL CROSS-COMPOUND PUMPING ENGINE

A Pennsylvania Historic Mechanical
Engineering Landmark



Susquehanna Section
The American Society Of Mechanical Engineers

York, Pennsylvania
May 7, 1982

THE YORK WATER COMPANY HISTORY OF RAW WATER PUMPING

Pumping engines have always played a major role in a growing community. Water was, and still is, a critical factor in the selection of a site for the new town or a new industry. The growth of a city and its business goes hand in hand with an abundant source of clean water.

The York Water Company, oldest investor-owned water company in Pennsylvania, began its operation in 1816 distributing spring water through log pipes. In 1849 it became clear that the town was outgrowing the spring capacity, and the Company decided to augment the supply by pumping water from the Codorus Creek. The location of the new station was near the present site of the St. Regis Paper Company plant. The new building demanded the installation of the latest equipment, a steam-powered pump.

According to The York Water Company legend, the fire in the first boiler was started from the pipe of a workman and burned continuously for 107 years until 1956 when the Company began pumping with electrically powered pumps.

As York became a booming industrial community, prosperity brought new problems to The York Water Company with pollution of the Codorus Creek. Without the knowledge of modern day processing, the only solution was to seek out a cleaner source of supply. The old pumping station was abandoned and a new raw water pumping station was constructed near Brillhart and was completed in 1897.

The Brillhart Station, the main pumping station, has been enlarged twice as York and the suburbs served by the water company have grown to a population of about 120,000.

At the pumping station, water from the Codorus Creek is lifted through a 36-inch main and two 24-inch lines to the filter plant two miles away. From there the flow from gravity alone assures sufficient water pressure for most of the York valley residents.

The original pumps and boilers have since been retired; however, until 1956 all pumping at the Brillhart Pumping Station was performed by the following steam operated pumps:

be held as a backup with possible change to electric-driven engine. The decision to switch to the diesel units was prompted by expensive repair to keep the boilers in operation and the

	<i>Rated Capacity</i>	<i>Date Installed</i>
<i>No. 1 - Worthington Centrifugal Pump Steam Turbine Driven</i>	<i>9 MGD</i>	<i>1925</i>
<i>No. 2 - Worthington Horizontal Cross Compound Pumping Engine</i>	<i>5 MGD</i>	<i>1925</i>
<i>No. 3 - Snow Horizontal Cross Compound Pumping Engine</i>	<i>8 MGD</i>	<i>1914</i>
<i>No. 4 - Worthington Centrifugal Pump Steam Turbine Driven</i>	<i>9 MGD</i>	<i>1946</i>
<i>Total Capacity</i>	<i>31 MGD</i>	
<i>Steam was supplied for operation from the following boilers:</i>		
<i>No. 1-Babcock & Wilcox Boiler, Oil-fired, 200 HP-Installed in 1946.</i>		
<i>No. 2 - Sterling Boiler, Coal-fired, 277 HP - Installed in 1925.</i>		
<i>Due to increasing fuel costs and expected decreasing electrical rates, three electric pumps were installed:</i>		
<i>No. 5 - Worthington Pump with 1000 HP EM Motor</i>	<i>18MGD</i>	<i>1956</i>
<i>No. 6 - Worthington pump with 1000 HP EM Motor</i>	<i>18MGD</i>	<i>1957</i>
<i>No. 7 - Worthington Pump with 750 HP EM Motor</i>	<i>9 MGD</i>	<i>1964</i>

Over the years the steam pumping equipment has been routinely tested to make certain it would be serviceable in emergencies, but additionally almost yearly, it has been needed to perform when repairs and installations of electrical pumps, service lines, mechanical overhaul and other demands had to be met. The equipment was also used during periods when Metropolitan Edison Company was undergoing power shortages, "Brownouts", generating plant failure, peak loads, or storm disruptions, and asked its fellow utility to release electrical energy.

Since it was in need of major repairs, and parts were not available, the No. 1 pump was removed in 1979. In 1981 the No. 4 pump has been converted to a diesel engine-driven pump and remains part of the backup. In 1982 the No. 3 pump was removed and replaced by a new 20 MGD diesel engine-driven pump. The No. 2 pump will be removed from service, but it will

lack of repair parts for the older steam-driven pumps.

After the 1972 onslaught of Hurricane Agnes that put the 750 HP electric-driven pump out of service for two days, and the two 1000 HP electric driven pumps for four days, the steam pumps saved the city from a critical water shortage.

The two steam engine pumps, had been kept with tender loving care. They have been thoroughly rebuilt with the help of the manufacturer and of local machine shops that have fabricated replacements for the moving parts of the pumps.

In spite of the historic interest in the steam pumps and the value of these units in standby capacity, the three electric-driven pumps are the work horses of the pumping station. Identical pumps No. 5 and 6, each with 18 MGD capacity, are run alternatively, on a weekly basis, giving plenty of time for adequate maintenance. Pump No. 7 supplements the delivery of the larger units as required.

THE CORLISS PATENT

At the time of its installation, the 1925 Worthington Horizontal Cross-Compound Pumping Engine, Pump No. 2, was a relatively small but highly efficient machine: a product of several hundred years of evolution. It utilized the special valve gear which had been introduced by George H. Corliss about 1850, thereby revolutionizing steam engine design. Often called the "queen of steam engines", the Corliss valve gear was exceedingly efficient. There were four rotary valves: two to admit steam from the boiler and two to exhaust the used steam to the condenser. This increased the efficiency of the engine in two ways:

- 1) The steam valves were not cooled by the exhaust and
- 2) All of the valves could be regulated separately. This type of gear is the most efficient control for standard medium speed steam engines (20 to 175 RPM).



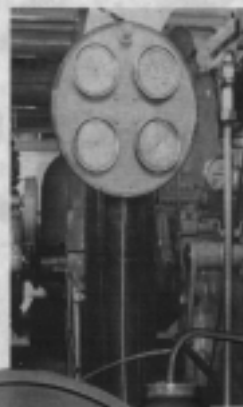
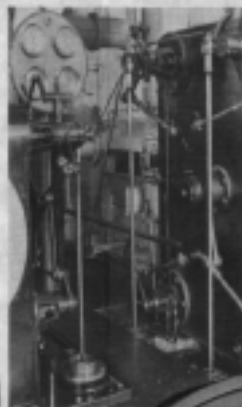
THE WORTHINGTON PUMP

Manufactured by Worthington Pump and Machinery Corporation, Snow Holy Works, Buffalo, New York, this pumping engine was an ideal machine because it operated at relatively slow RPM, in this case 40, and the steam could work expansively through two cylinders (hence, cross-compound) before being condensed by a surface condenser.

Many water companies installed units such as this, as they could reasonably supply between 6 and 12 MGD. This was a very good apparatus that was considerably smaller and cheaper than a triple expansion vertical engine used during this time.

This type of crank and flywheel engine, therefore, represents the height of American engineering and technology from the 1860's to World War I.

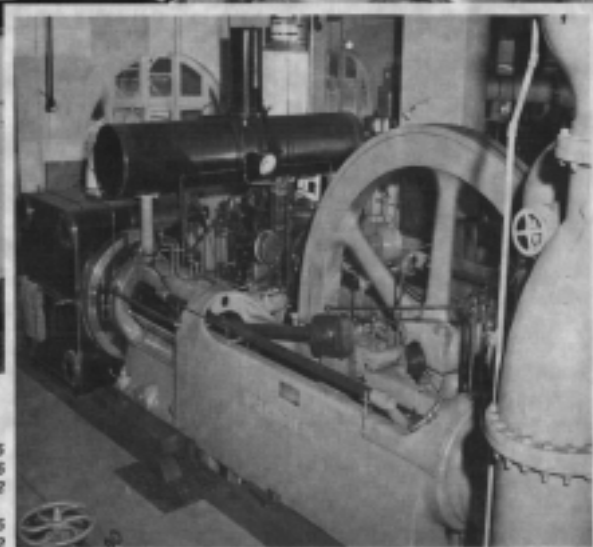
This is the only known operating engine of its type in the states of Pennsylvania, Maryland, New Jersey and Delaware.



SPECIFICATIONS

Workpower: est. 225
 Steam pressure: 165 psig
 Water pressure: 125 psig
 Reciprocating speed: 40 rpm
 High pressure cylinder diameter: 28 1/2 inches
 Low pressure cylinder diameter: 44 inches
 Water cylinder diameter (2): 13 1/2 inches
 Stroke: 36 inches
 Condenser: Surface type
 Governor: Hydraulic
 Engine: *S-152

*"Square" or "W pattern", there are two sets of opposing cylinders. I.e. one cylinder in each corner with the flywheel in the middle.



In-Service	1925
Stand-By	1956
Hurricane Agnes (Jumped 7 days)	1972
Hurricane Eloise	1975
Out-Of-Service	1982

PENNSYLVANIA HISTORIC MECHANICAL
ENGINEERING LANDMARK

WORTHINGTON
HORIZONTAL CROSS-COMPOUND

CORLISS STEAM ENGINES, CHARACTERIZED BY FOUR CYLINDRICAL OSCILLATING VALVES, EACH SEPARATELY CONTROLLED BY CUT-OFF GEAR (pat., 1849), DROVE MANY TYPES OF MACHINERY AND ENJOYED GREAT COMMERCIAL SUCCESS THE WORLD OVER DURING THE LATTER HALF OF THE 19th CENTURY AND WELL INTO THE 20th.

THE HIGHLY EFFICIENT STEAM DISTRIBUTION SYSTEM WAS CONCEIVED BY GEORGE H. CORLISS (1817-1888) OF PROVIDENCE, RHODE ISLAND.

THIS PUMPING ENGINE WAS BUILT BY THE WORTHINGTON PUMP & MACHINERY CORPORATION, SNOW-HOLLY WORKS, BUFFALO, N.Y.

THE AMERICAN SOCIETY
OF MECHANICAL ENGINEERS
SUSQUEHANNA SECTION

1982

YORK WATER COMPANY
1816 — 1896

ACKNOWLEDGEMENTS

The Susquehanna Section of the American Society of Mechanical Engineers gratefully acknowledges the efforts of all who co-operated on the landmark dedication of the Worthington Horizontal Cross-Compound Pumping Engine.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Dr. Robert B. Gaither, President
Dr. Richard A. Kenyon, Vice President, Region III
George Kotnick, Governor
Dr. Burke E. Nelson, Executive Director

The ASME National History and Heritage Committee

Prof. J.J. Ermenc, Chairman
Dr. R. Carson Dalzell, Secretary
Prof. R.S. Hartenberg
Dr. J. Paul Hartman
Prof. Edwin T. Layton, Jr.
Prof. Merritt Roe Smith
Robert M. Vogel, Ex-Officio, Smithsonian Institution

The ASME Susquehanna Section

Garrick Solovey, P.E., Chairman
James B. Patterson, Past Chairman
Michael R.C. Grandia, P.E., Chairman, History & Heritage

SOCIETY FOR INDUSTRIAL ARCHEOLOGY

Stephen G. Heaver, Jr.

THE YORK WATER COMPANY

William Morris, P.E., Executive Vice-President
Duane Close, Operations Manager
Irving Wolf, Superintendent

WORTHINGTON GROUP, McGRAW EDISON COMPANY

Cecil Thrash, Manager, Public Relations
Leonard Graziano, Eastern Region Manager
Bruce Nelson, Product Engineer

WORTHINGTON HISTORICAL HIGHLIGHTS WATER WORKS PUMPING ENGINES

- *Founder, Henry R. Worthington (1817-1880)*
- *Built first Direct Acting, Single Acting Pump in 1840.*
- *Built first Direct Acting, Double Acting Pump in 1844.*
- *Worthington and Baker Company formed in 1845.*
- *Built first Water Works Pump for Savannah, Georgia in 1854 (300,000 GPD).*
- *Invented the Direct Acting, Duplex, Double Acting Pump in 1857.*
- *In 1863, for the city of Charlestown, Mass., the first Horizontal Duplex Compound Pump of water works size was built (5 MGD).*
- *In 1876 a Worthington Compound Duplex Pumping Engine (6 MGD) was installed at the Centennial Exhibition in Philadelphia, Pa. where it not only supplied all the water for the grounds, but also was awarded the Gold Medal for excellence in design and performance.*
- *Henry R. Worthington was instrumental in founding the ASME in 1880.*
- *In 1886 the first Vertical Water Works Pumping Engine was built and installed in Cincinnati, Ohio.*
- *The largest (40 MGD) Vertical Triple-Expansion Pumping Engine ever built was installed in Chicago, Illinois in 1904.*

The Worthington Horizontal Cross-Compound Pumping Engine is the fifth ASME State Historic Mechanical Engineering Landmark to be designated since the program began in 1973. A total of 72 state, national, and international Historic Mechanical

Engineering Landmarks have been designated to date.

For a complete list of the Society's Landmarks and information about the ASME History and Heritage Program, please contact The Public Information Department, ASME, 345

East 47th Street, New York, NY 10017 (212/644-7740).

This brochure was compiled by Stephen G. Heaver, Jr. and edited by Michael R.C. Grandia.