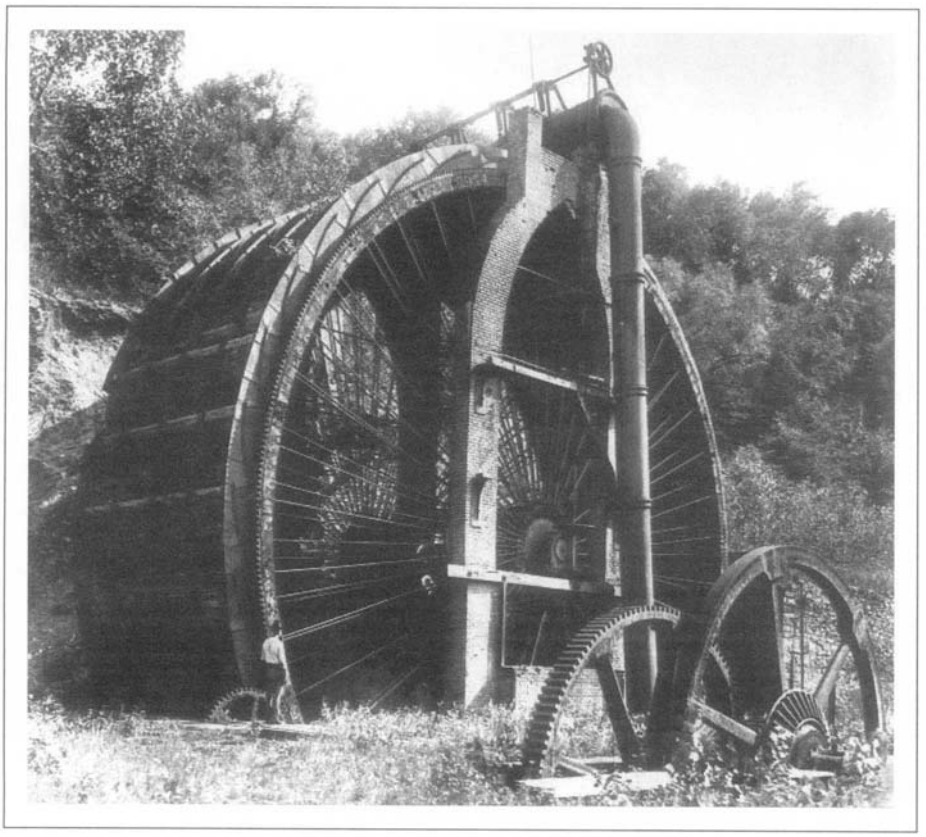
How Things Work: Power

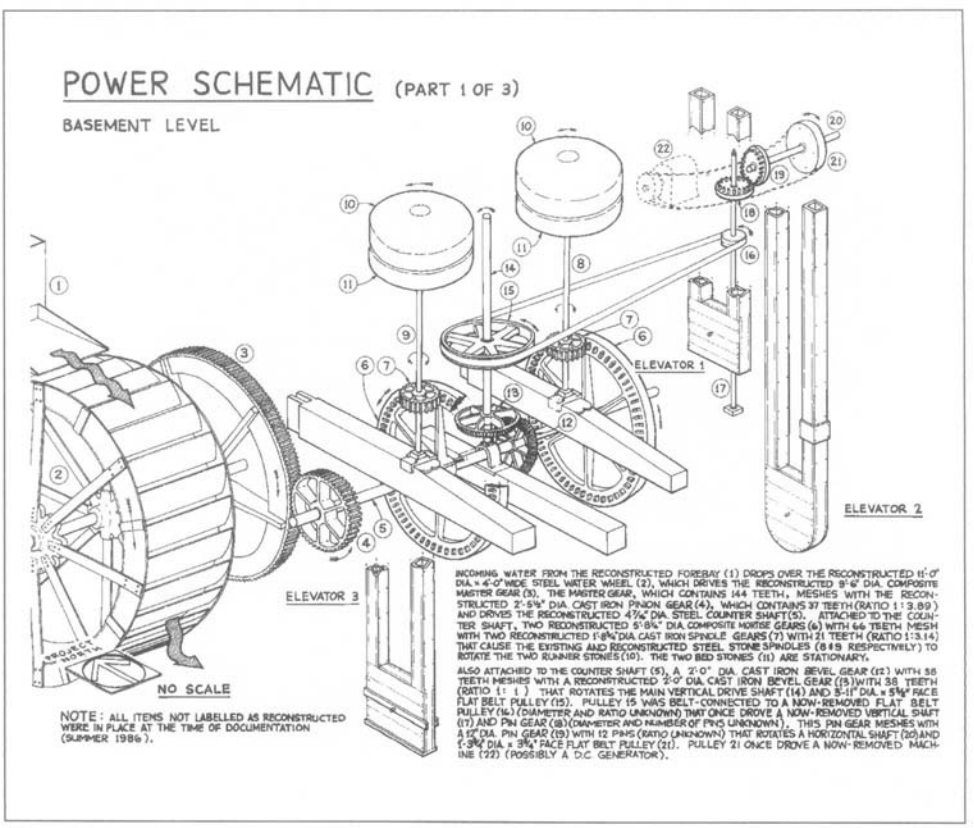


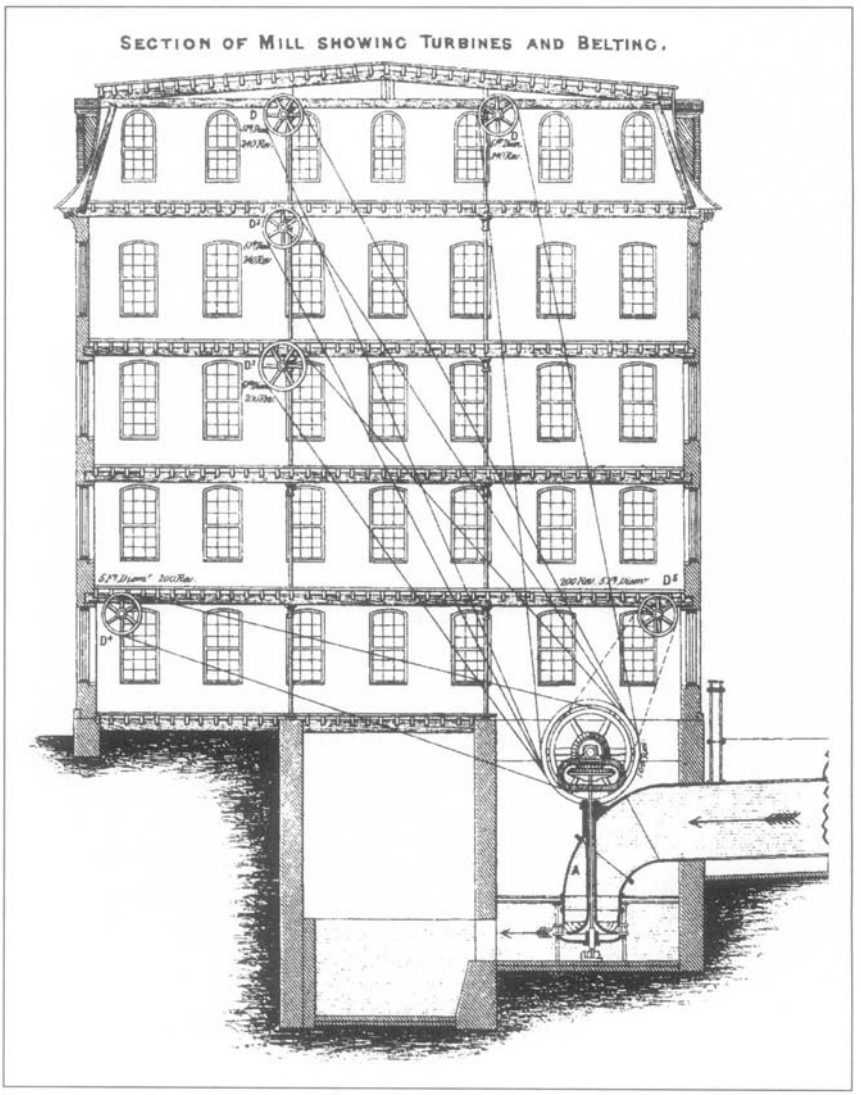
[LEFT] *Burden Water Wheel, built in 1851, Troy, New York.*

The "Niagara of Water Wheels" was built in 1851 by ironmaster Henry Burden to power his horseshoe factory and ironworks in Troy, New York. The mammoth wheel, which had a diameter of 60 feet, was one of the most powerful waterwheels ever built. It was destroyed in 1942 in a scrap iron drive.[20]

[RIGHT] *Power schematic, Mount Pleasant Grist Mill, c. 1805, near St. Peters, Pennsylvania.*

Water provided much of the power to operate American machinery in the nineteenth century, especially in the first half of the century. Waterwheels, such as this one for a grist mill, and water turbines turned a complex set of gears and belting to perform a variety of tasks.

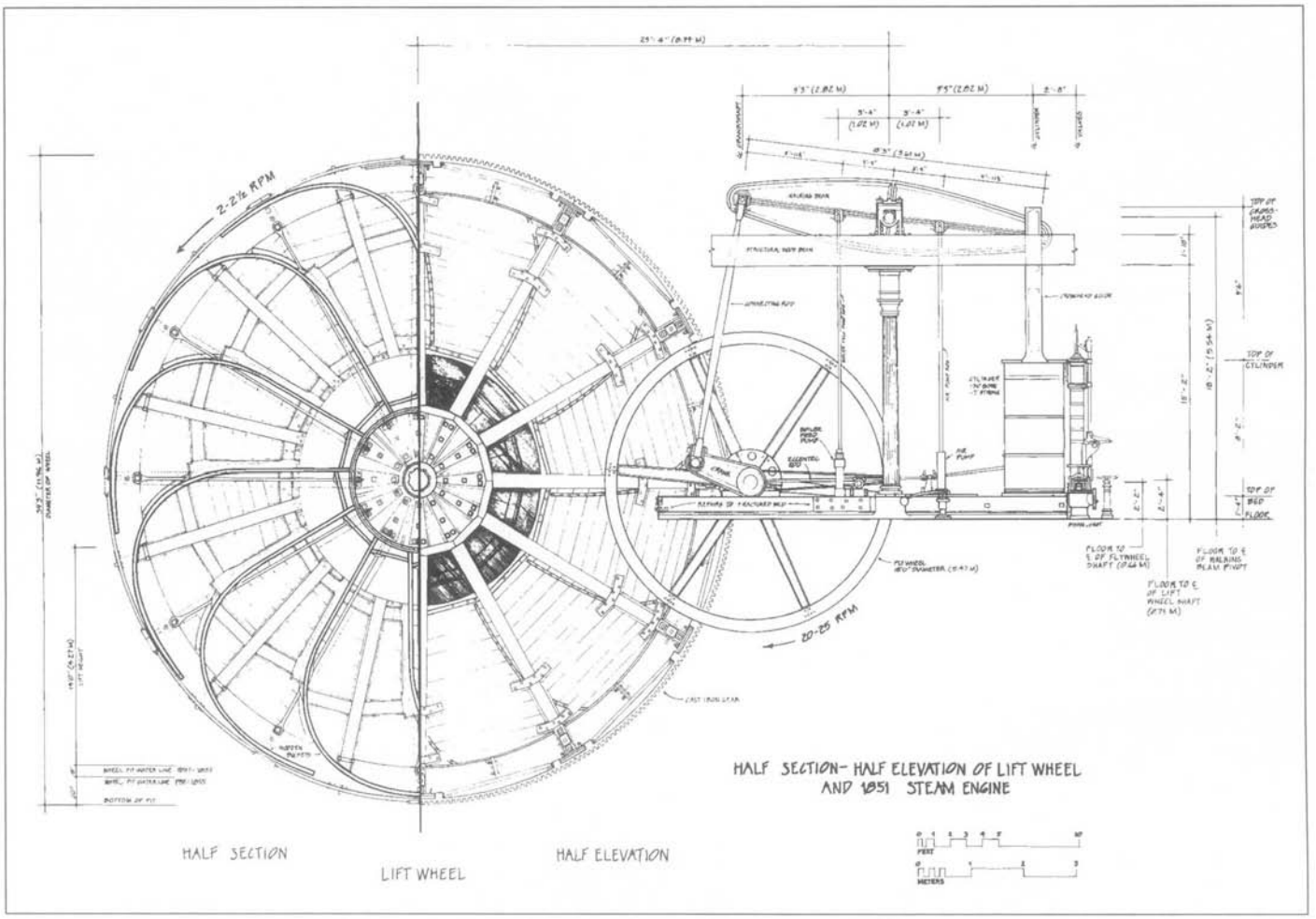




[RIGHT] *Belting transmitting power to the mill's machinery from water turbines, Harmony Manufacturing Company, Mill No. 3, 1866-1872, Cohoes, New York.*

[LEFT] *Sugar mill steam engine, 1861, Hacienda Azucarera La Esperanza Sugar Mill, Manati, Puerto Rico.*

During the second half of the nineteenth century, steam became the dominant power source. The West Point Foundry of Cold Spring, New York, manufactured in 1861 both this Gothic-style beam engine and cane mill, which crushed sugar cane. The La Esperanza engine is the only West Point Foundry beam engine known to survive and the only known six-column beam engine made by any American manufacturer.



Section and elevation of lift wheel and steam engine, 1851, Chesapeake and Delaware Canal Pump House, Chesapeake City, Maryland.

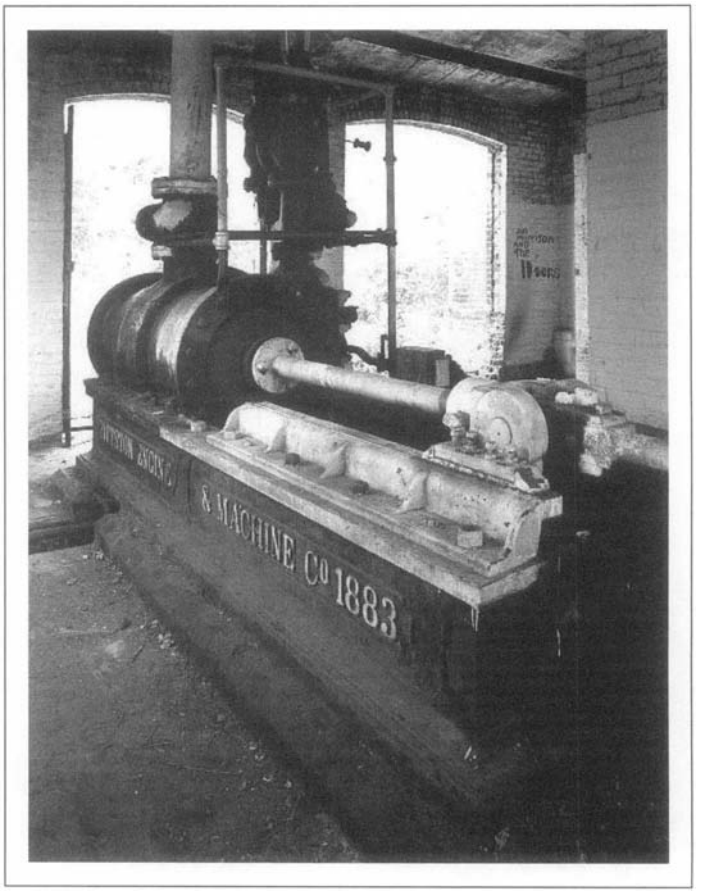
The Chesapeake and Delaware Canal opened in 1829 to connect the Chesapeake Bay and the Delaware River. From the beginning, however, there was not enough water along the summit level of the canal to make up for that lost in lockage, and in 1851 Samuel Merrick and John Towne of the firm of Merrick and Sons of Philadelphia, Pennsylvania, installed a 39-foot diameter lift (or scoop) wheel and a system of raceways that transferred water from a nearby creek into the canal. The wheel, powered by a steam engine, delivered more than 200,000 cubic feet of water per hour into the canal. A second engine was added in 1854, and the lift wheel was replaced in 1856, but no other changes were made in the system until 1927, when the canal was renovated as a sea-level canal without locks.

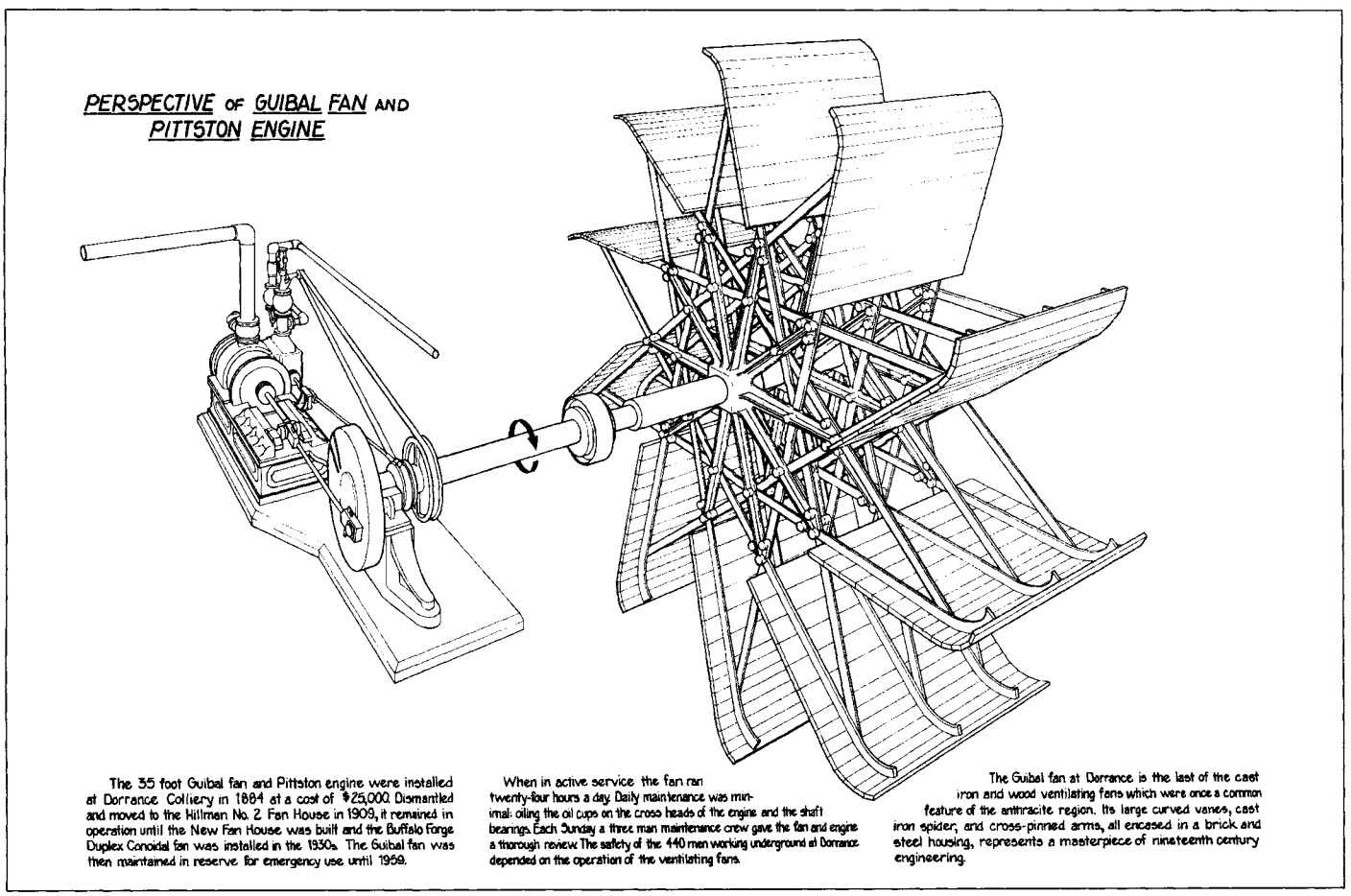
Dorrance Colliery Fan Complex, 1883, Wilkes-Barre, Pennsylvania.

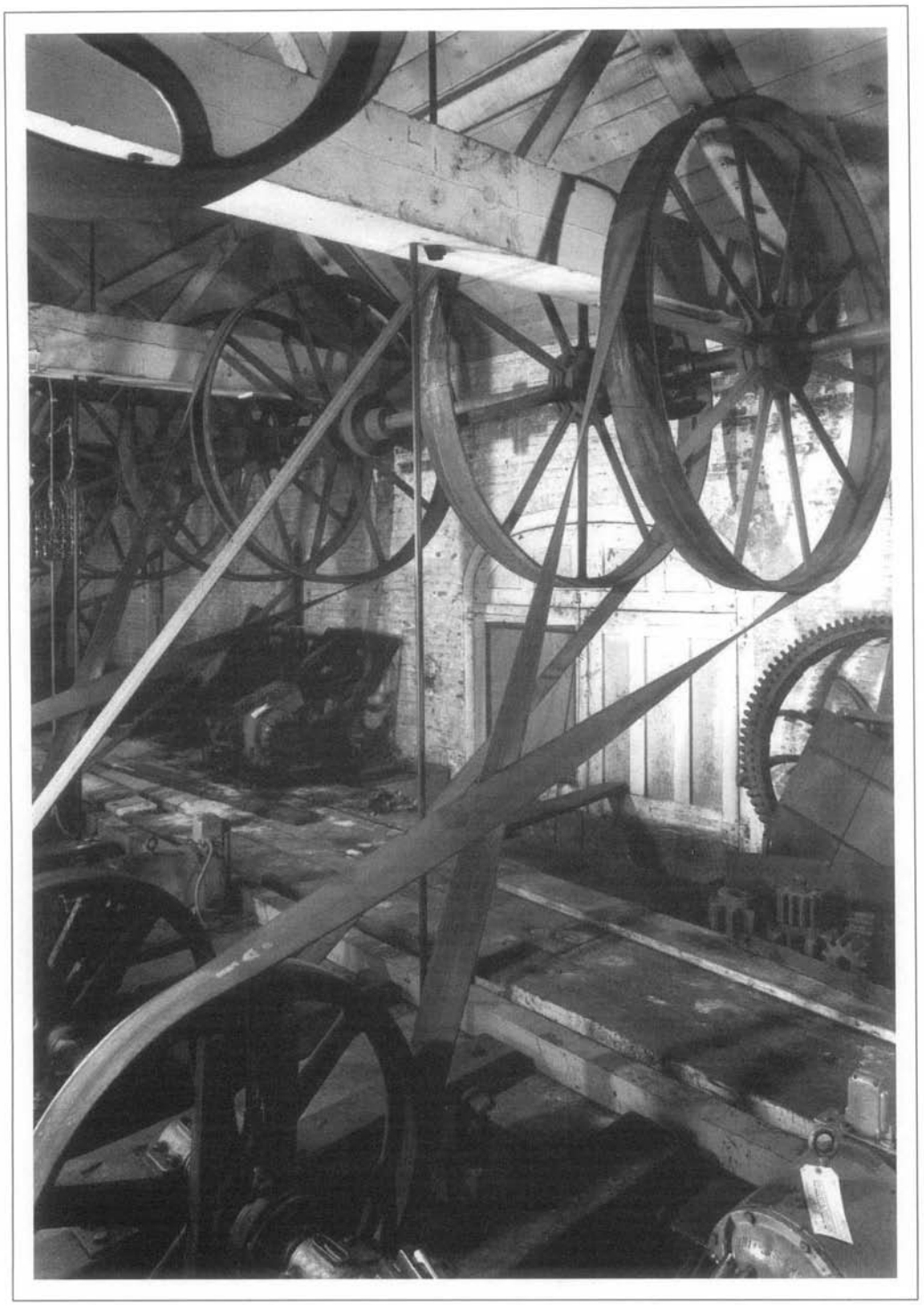
[RIGHT] *Steam engine for mine fan.*

[BELOW] *Steam engine and Guibal fan.*

Anthracite coal was mined at the Dorrance Colliery near Wilkes-Barre, Pennsylvania, beginning in 1883. Ventilating fans were necessary to provide fresh air to the underground workings and to remove noxious gases. This steam engine and Guibal fan were manufactured in 1883 by the Pittston Engine and Machine Company of West Pittston, Pennsylvania. The fan, of wood and cast iron, was 35 feet in diameter and was driven by the steam engine at a rate of 49 revolutions per minute. When in active service, it ran 24 hours a day.







Line shaft, pulleys, and belts of the hoisting machinery, Pawtucket Gatehouse, Northern Canal, Lowell, Massachusetts.

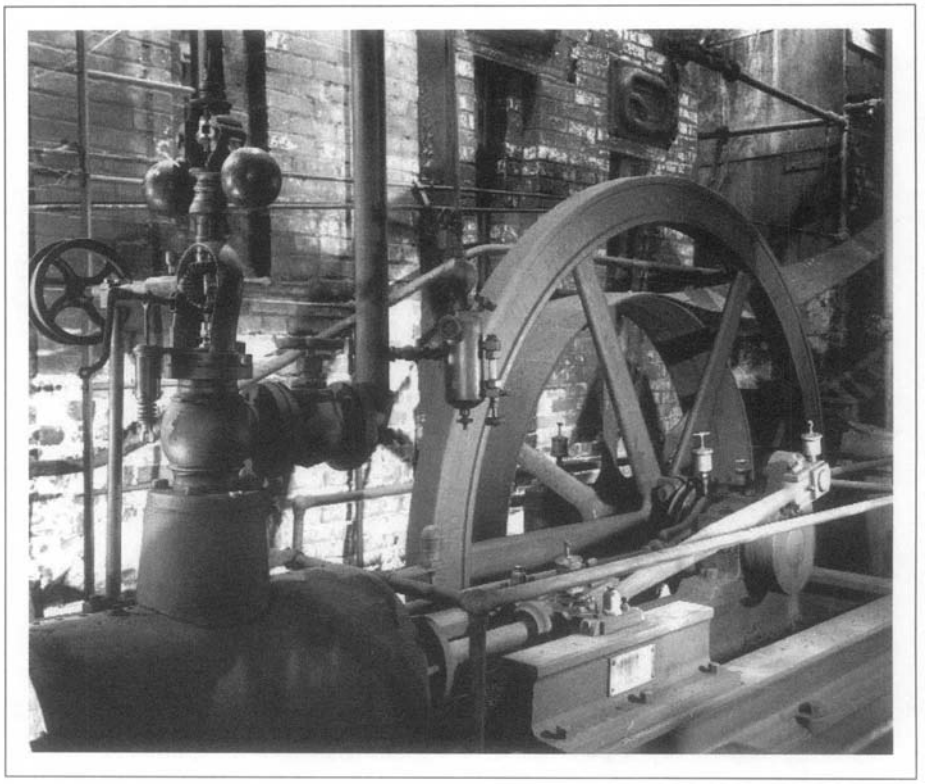
Power was transmitted throughout much of the nineteenth century by leather belt drives, which were gradually replaced in the next century by electric motors.

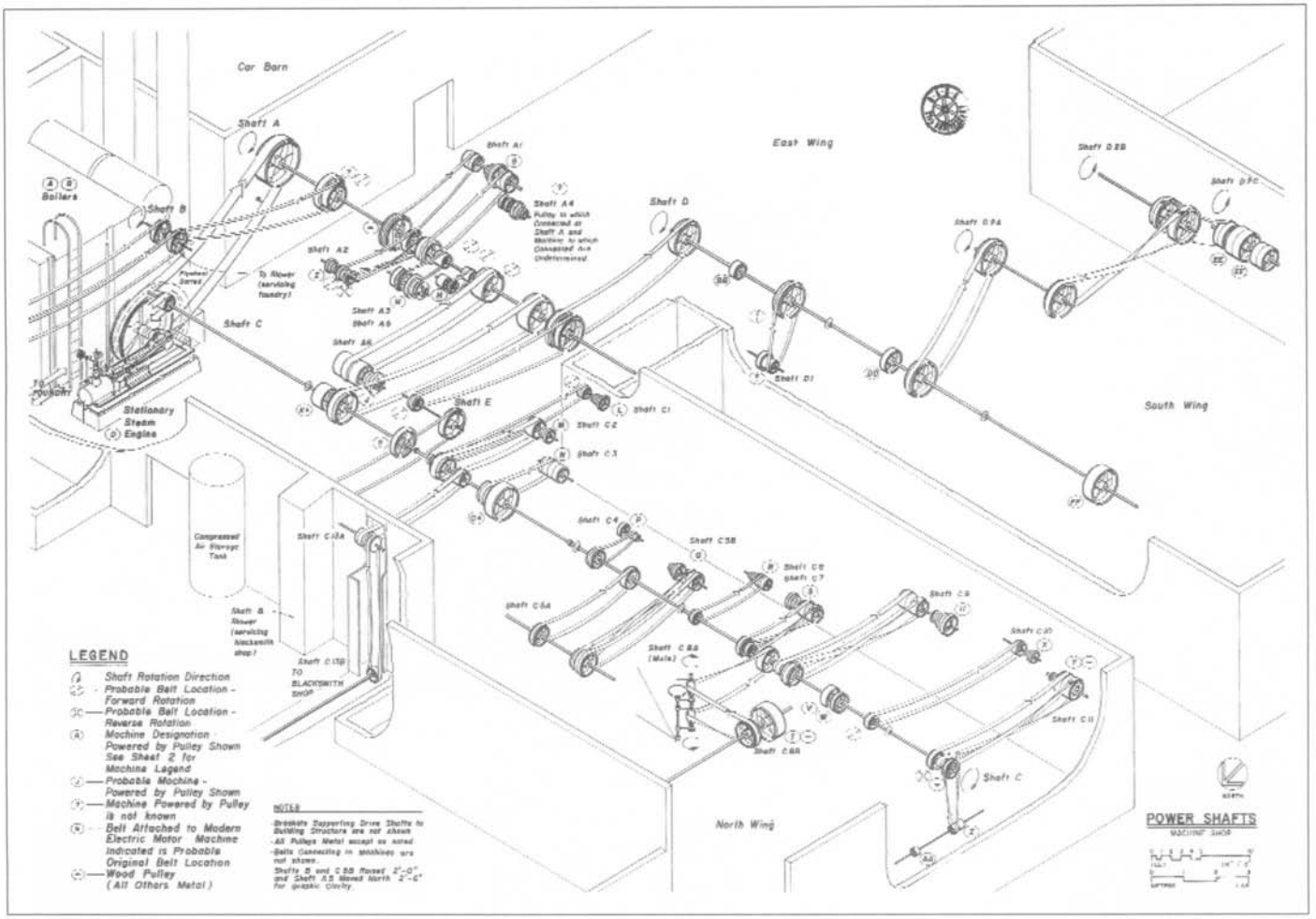
Machine Shop, East Broad Top Railroad, Rockhill Furnace, Pennsylvania.

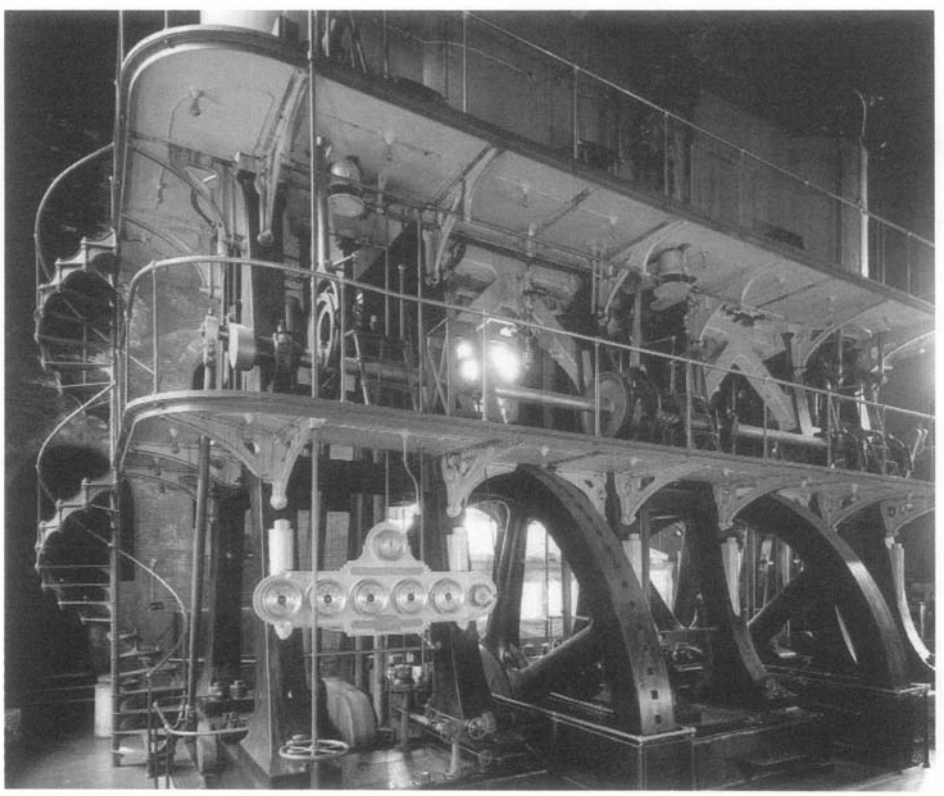
[RIGHT] *1882 steam engine in the Machine Shop powered the overhead lineshaft system in the railroad shops.*

[BELOW] *Overhead lineshafting in Machine Shop.*

A complex arrangement of overhead lineshafts in the East Broad Top Railroad Machine Shop was powered by a steam engine, erected in 1882. The system included nearly 36 separate shafts that powered machinery in several of East Broad Top's shops.



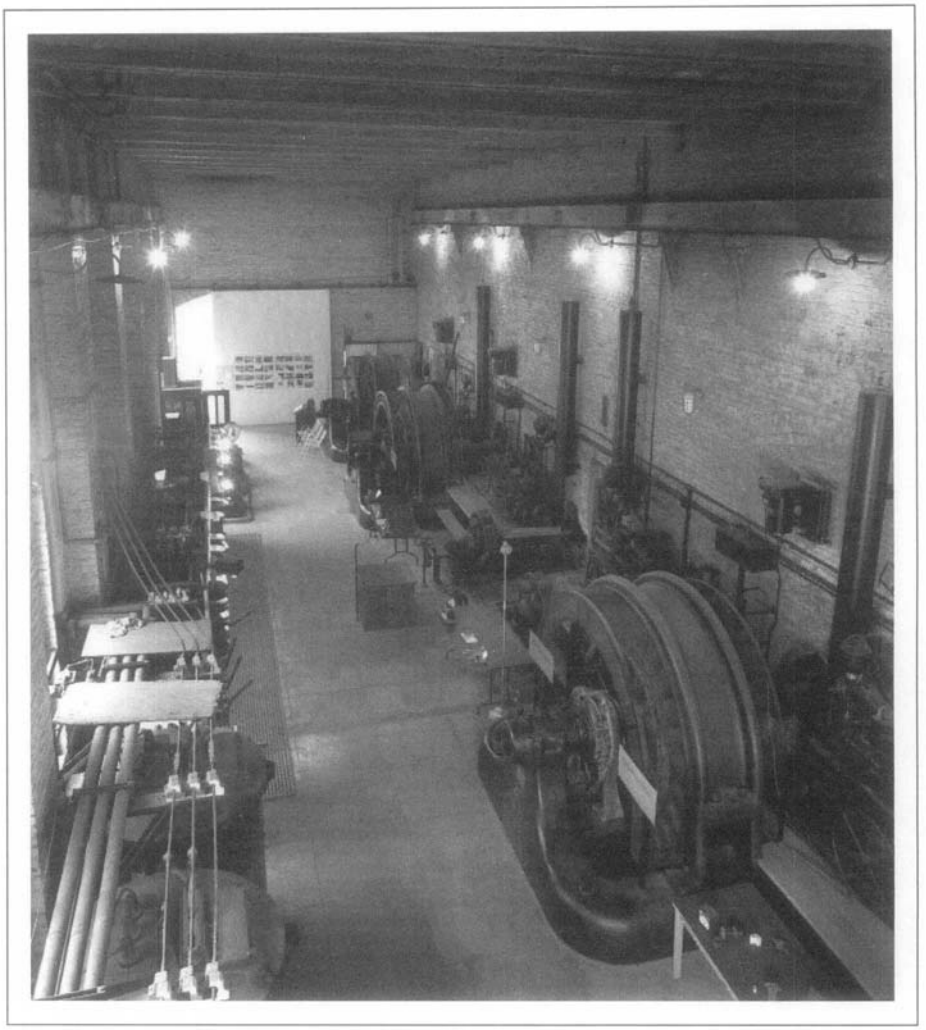




[ABOVE] *Lineshafting in the Machine Shop.*

[LEFT] *Leavitt Pumping Engine, 1894, Boston Water Works, Boston, Massachusetts.*

The Leavitt Pumping Engine was installed in the Chestnut Hill High Service Pumping Station of the Boston Water Works in 1894. Designed by Erasmus D. Leavitt, Jr., a prominent American mechanical engineer, this triple-expansion steam pumping engine was capable of pumping 20 million gallons of water per day.



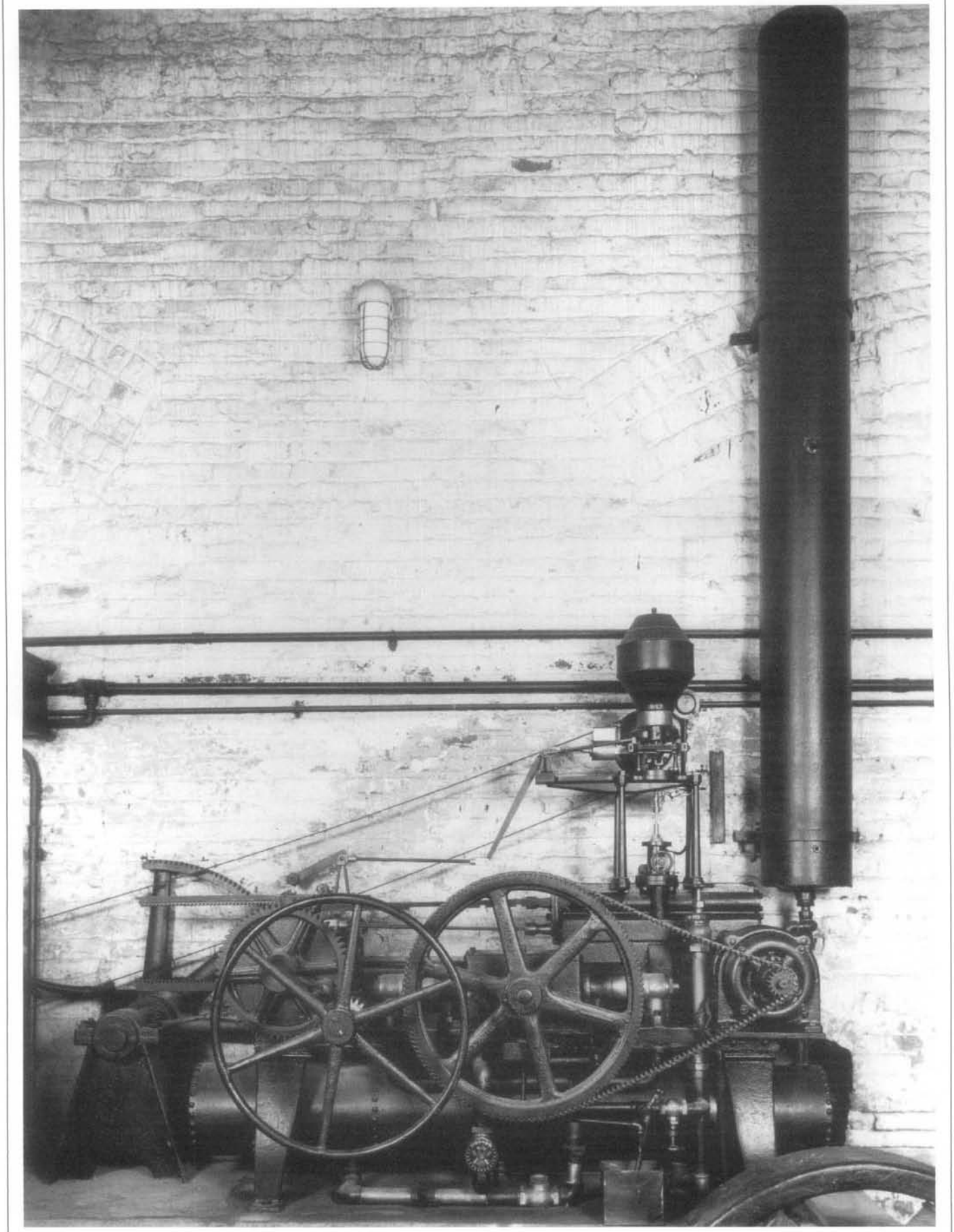
Folsom Powerhouse, 1895, Folsom, California.

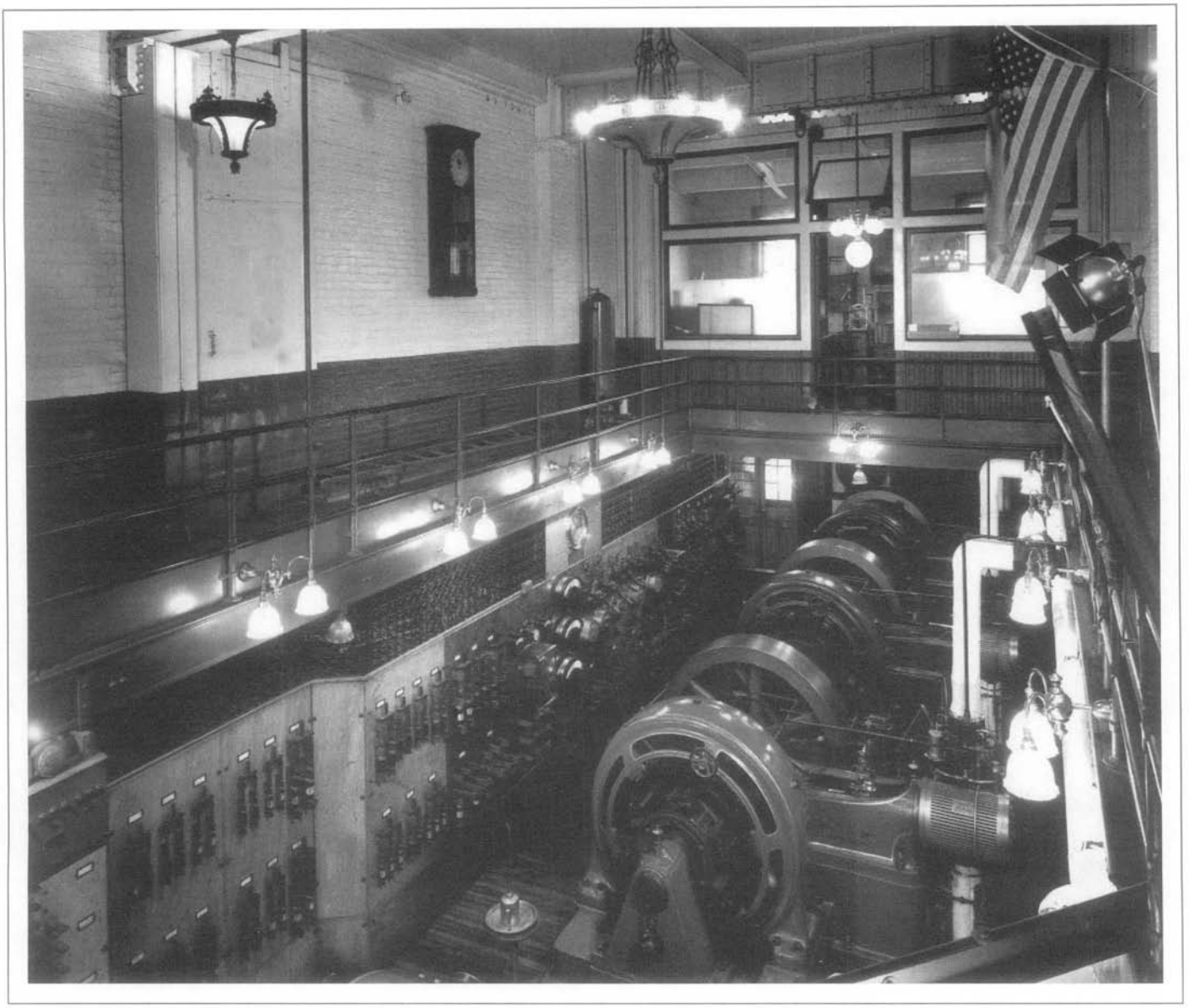
[ABOVE] *Interior.*

[LEFT] *Generator No. 4.*

[FACING PAGE]
Governor of Turbine No. 3.

The Sacramento Electric Power and Light Company constructed the Folsom Dam and Powerhouse on the American River in California in the early 1890s. Folsom was not the first hydroelectric power plant in the country, but when in 1895 it successfully transmitted power to Sacramento, California, 24 miles away, it achieved the longest commercial power transmission to date. Equipment in the powerhouse included four water turbines driving 750-kilowatt General Electric generators.[21]





Power plant, 1900, Pratt Institute, Brooklyn, New York.

When the Pratt Institute, a technical training school in Brooklyn, New York, expanded in the late 1890s, new electrical equipment was added to the power plant. This included three new steam engine generators manufactured by General Electric and single-cylinder engines by Ames Iron Works of Oswego, New York.[22] These were among the oldest steam-powered electric generators in the country when recorded by the Historic American Engineering Record in 1974.