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SETH BOYDEN--THE UNCOMMERCIAL INVENTOR

Seth Boyden

Seth Boyden, who gave America the methods of producing patent leather and malleable cast iron, is a strange figure in the great group of American inventors of the early 1800's who helped to stimulate the rise of the Nation's industrial life. No less than three times the inventor had within his grasp a large fortune. Each time he turned from making money out of one of his inventions to the investigation of some different mechanical problem, letting others make profits that should have been his.

He was born at Foxborough, Mass., November 17, 1788, the son of a "minute man" of the Revolution. He had an ordinary eighteenth century education, attending a small district school but two months a year. His scientific training came from his father, himself an inventor. Although Seth worked on his father's farm and sometimes at his grandfather's iron furnace, he showed an early aptitude for mechanics; at 15 he repaired watches. He revealed the bent of his mind in a book label, engraved on steel; it showed a shelf of books, a retort, jars of chemicals, a barometer, a thermometer and an electrical machine. After building a high-power microscope he invented an air rifle that could kill small animals. He devised an ingenious improvement on current gun locks and made a rifle according to his own design.

Boyden soon applied himself to devices of industrial and commercial value. He reduced the cost of wrought-iron nails, tacks, brads and files of different sizes by inventing machines to make them. By improving a machine to split leather, invented by his father, he made it commercially valuable. Splitting hides into two or more layers increased the quantity of leather available from each.

In 1815, the year after he married Abigail Sherman, he moved to Newark and opened a little harness shop in his home on Broad Street near Bridge Street. It is probable that Boyden came to this city because of its extensive commerce in leather and its products, particularly shoes. He brought with him his machine for splitting leather and soon had a flourishing business. Characteristically, he made an innovation in the new venture by developing his own method of silver-plating buckles and other articles for use on harnesses and carriages.

One day he heard someone read a carelessly written account of the French glazed leather produced in Europe and searched until he found a specimen in New

York, the enameled peak of a German military cap. Because the material was rather brittle, it was not widely used. Although he had no knowledge of the process, he analyzed the enamel and improved on the imported product. He thought that this new "patent leather" would be suitable for harness decoration and for a period manufactured it only for his own business.

Despite the name "patent" leather Boyden never patented the process which he invented. In fact he persistently declined to use the protection of his rights afforded him by law; all his inventions became public property, for anyone to profit from them, and Boyden was generally the least likely to do so. "Patent" leather, now so closely identified with dress shoes and purses, probably got its name from the process of baking, known technically as "patenting."

The process consisted in placing several layers of japan or varnish on the leather, all but the final coats being dried in the sun; it was then polished. In 1818, when he built a plant to produce patent leather, he changed the process by drying the japanned leather in a specially designed oven. In 1822 sales were $4,521 and by 1828 had grown to $21,500. But he became interested in another problem and sold his business. He lived to see $6,000,000 profitably invested in the production of patent leather in Newark alone.

At his grandfather's iron furnace Boyden had learned the differences between cast iron, which was very hard and brittle and could not be mended when broken, and wrought iron, which was softer and tougher and could be bent when heated but was far more expensive. Americans had to use either expensive hand-forged wrought-iron hardware made in this country or import from England malleable cast iron made by a secret process.

Once young Seth observed that part of a cast-iron bar that had been near the fire bed of a furnace and had been heated to a high temperature for long periods of time had taken on the appearance of wrought iron. He found that by heating this he could hammer it like wrought iron and change its shape; but the part that had not been continuously heated was still hard and brittle.

Twenty years later when he was still conducting his harness shop in Newark and had to use expensive wrought-iron hardware, he began to experiment on malleable cast iron. He built a small forge in his house and there melted and refined in a crucible small quantities of pig iron which he cast into spikes. These he baked for long periods in his furnace. He tried many kinds of crude iron until he found one that proved best for his purpose; he experimented by adding such substances as sulphur, phosphorus, tin, zinc, lead, antimony and nickel to the molten iron, but such additions did not help; he tried many kinds of packing material in which to bake the castings. For six years he persisted in his search. Finally, on July 4, 1826, he produced the first satisfactory malleable cast iron in the United States. Without modern methods of chemical analysis, he had found iron from a certain iron works that had just the right amount of carbon in it. The castings he made from this iron he then baked at high temperature continuously for nine days and nights, when it was found annealed, or softened, so that it could be hammered without breaking.

Boyden's discovery freed America from dependence upon England for imported malleable castings and wrought iron and from the necessity of making many articles by expensive hand forging. His new method was one of the most important steps in the development of modern steel.

He built a small factory for producing articles from malleable iron castings. As the business grew he employed sixty men and operated his furnaces from early morning until late at night. Over a thousand useful articles were made by his new process, and he was widely recognized for his notable discoveries and success in manufacturing. In 1828 the Franklin Institute of Philadelphia pre-

sented to him a silver medal for an exhibit of malleable cast iron articles. He could have become wealthy, but in 1835 he sold out again.

His next effort was with an invention which had only just begun to stir the imaginations of Americans. After the Camden and Amboy Railroad had been laid between Camden and South Amboy in the early 1830's promoters sought to build railroad lines all over the State. The Morris and Essex Railroad between Orange and Newark needed an engine to pull the train up the steep hill between the towns. Boyden, although he had never built a locomotive, promised to design one to do the job. In 1837 he produced the *Orange* and the following year the *Essex*, which remained in service for a long time.

Boyden attacked the problem of steep grades by substituting a straight axle for the crank, to which power was applied. He put the driving rod outside the engine and used the wheels as the crank. He also invented a "cut-off" to regulate the amount of steam injected into the cylinder of the steam engine. Among his other improvements was the "link motion," which enabled the engineer to reverse with greater ease. His fame as a locomotive builder reached Cuba, where he went in 1841 to build the *Cometa* for the Cardenas Railroad.

For the next few years Boyden restlessly turned from one idea to another, without developing anything genuinely significant. For the young astronomers of Newark he built a telescope, grinding the lenses himself. He studied air compression and air pumps and improved the photographic process of the Frenchman Daguerre by using a reflector to increase the power of the sunlight. Credited with having built the first camera in this country, he also made the first Daguerreotype in the United States. He helped Samuel F. B. Morse with the electric telegraph and constructed various electrical appliances for his home, such as a clock, a fountain and a barometer.

A clue to Boyden's working habits is provided by one of his inventions. Lest he lose valuable ideas that occurred to him after he had gone to bed, he contrived a slate on which he could write in the dark. His hand was guided by wires strung across the surface of the slate.

Boyden nearly always slept with his clothes on, boots and all. Every morning, winter and summer, he took a bath by plunging into a cold spring, without bothering to take off his clothes. When the bath had been put off until near the time for starting work he came into the shop with water dripping from his clothes. He claimed that the bath was as good for the clothes as for him.

Nothing in Seth Boyden's life indicates that he cared seriously for riches. Again and again he avoided detours leading to wealth and consistently traveled the highway of scientific inquiry. Yet in 1849 this man joined thousands of others in the stampede to California for gold. With his son Obadiah he took a ship to Panama, crossed the Isthmus on donkeys and then sailed up the Pacific coast in the second steamboat to navigate in those waters. The arduous trip was fruitless; no inventor's magical skill could extract gold from the earth. After twenty months, in which they mined enough only to meet their expenses, father and son dispiritedly returned to Newark.

Although his adopted city esteemed him as an eminent citizen and fired cannon upon his arrival, there seemed little opportunity for the man whose inventive mind had laid the foundation for several of the city's most profitable industries. Boyden showed no concern over his impoverished state, and when he discovered a process of making Russia sheet iron cheaply he sold it to a group of local manufacturers for a small sum. The picture of Boyden's want amidst the plenty he had helped to create finally impelled some businessmen, who had become rich from his inventions, to buy him a small farm at Hilton, a suburb of Newark. Here he lived for the last fifteen years of his life.

Unable to stay idle, he undertook to improve the strawberries then grown. Beginning with plants that produced large sour berries and others that bore small sweet berries, he planted them in alternate rows. These he hybridized carefully and then submitted a fine specimen to forty-eight hours in a freezing mixture, producing the effects of a winter in the ground and thus obtaining seeds and plants the same season. By such methods he rapidly increased the size of berries from his plants, while also improving the flavor. Some of these "Hilton" or "Boyden" strawberries weighed fifteen to the pound and won him fame as a horticulturist. From one of his varieties he received a fair income, but most of his plants were given to his neighbors.

To support himself he worked for a hat manufacturer in Newark. He often walked the several miles to work and appeared content with his wages of $50 a month. When a friend wrote a letter to a newspaper suggesting that a fund be raised to permit him to retire, Boyden refused to allow it.

Even in the hat factory his old habit of improving apparatus with which he was working asserted itself. He redesigned a machine for forming hat bodies which, oddly enough, was the only patent that he ever seemed to care to restrict for his own benefit. Stranger still, this was one of the few of his inventions contested in the courts. His rights were sustained, and at 80 he continued to work in the factory which his invention had helped to make prosperous.

Boyden was not above experimenting upon himself. One day he appeared at the factory with his iron gray hair turned jet black. To charges of vanity he replied seriously, "It is a scientific investigation. I have been experimenting on getting up a new hair dye to oblige a friend who wants to get married again." Boyden was not entirely successful; the dye began to lose its strength and his hair turned dark purple. He tried other chemicals, only to have his hair work its way through most of the colors of the rainbow. When it reached a rusty yellow, he sadly abandoned the task.

Early in 1870 the inventor, looking ahead rather than back over his long life, told a friend that he had plans for enough experiments and inventions to fill two more lifetimes. Within a few months these plans were part of his legacy to posterity, for on March 31 he died quietly at his home.

The city did not forget. In 1871 General Theodore Runyon began a movement to erect a suitable monument to his memory. Nineteen years later a bronze statue of Seth Boyden was unveiled in Washington Park, Newark, not far from the site of his harness shop. It represents the inventor as he would have liked to be remembered: sleeves rolled up, clad in a blacksmith's leather apron, in his hand a model of a locomotive. The original tablet on the monument was stolen about 1913. In 1925 the Newark Schoolmen's Club, with the help of small gifts from school children, replaced it with the present large plaque.

To pay Boyden tribute came another great American inventor, who had also done most of his work in New Jersey, Thomas A. Edison (see Bulletin No. 8, 1939-40 Series). At the ceremonies he said what he had previously expressed to the committee in writing. "Seth Boyden was one of America's greatest inventors, and one who had never received proper credit for his many great and practical inventions. They have been the basis of great industries which have spread over the entire world and give employment to millions of people."

The statue inconspicuously placed in the park does not wholly serve its purpose of recalling to Newark the memory of one of its most useful citizens. Recently his name has been restored to public consciousness by naming one of the city's low-cost housing developments Seth Boyden Court. But his most lasting memorial, more enduring probably than the bronze, now turned green, are the factories and foundries of the city he helped make a great industrial center.