

A CENTURY OF INDUSTRY IN PENNSYLVANIA

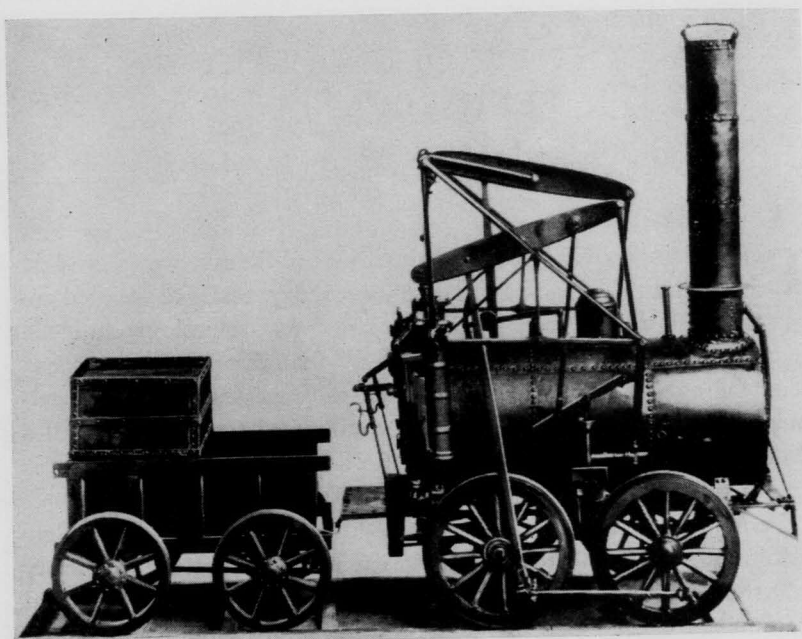
BY DR. SYLVESTER K. STEVENS, *State Historian*
Commonwealth of Pennsylvania

THE history of industrial enterprise in Pennsylvania, and in the nation, during the last one hundred years is associated intimately and inseparably with the story of technology and the machine. It is almost trite today to say that the past century has been the age of the machine. Back of the machine have been science, invention, engineering, and technological training. It is all a closely integrated process and no one advance or improvement is totally unrelated to the other.

Pennsylvania in 1850 already was in the stages of a complete revolution in its industrial development. The revolution already in process was to provide foundations for the later and rapid emergence of the Keystone State as one of the nation's titans of industry.¹ A bit of background is necessary to appreciate the 1850 setting. Pennsylvania, like all of its sister colonies and states, was characterized by what may be termed a colonial economy until the end of the American Revolution. A colonial economy is dependent upon foreign trade and the export of a limited number of products of the farm and forest. From this trade develops the supply of free capital available for general use. Lacking much capital, the greater part of the economy is one of barter and self-subsistence. Philadelphia, as the major colonial seaport of the 18th century, was the hub of Pennsylvania's early economic development.

Three things helped shake Pennsylvania loose from the foundations of a colonial economy. One was her early supremacy in the manufacture of iron. While the iron industry did not take root in Penn's province until about 1720, within three decades Pennsylvania was the leading producer. The iron industry was

¹ The basic conclusions and facts in this study are drawn from the author's larger work *Pennsylvania, Titan of Industry* (N. Y., 1948).



"OLD IRONSIDES"

Pioneer locomotive of Philadelphia, built by Matthias Baldwin.

Courtesy Pennsylvania State Department of Commerce

America's first larger scale type of industrial enterprise, demanding more capital and more technical processes than were common to most industry of the time. A second factor in Pennsylvania's emergence from a colonial economy was the importance of Philadelphia commerce. This produced an early development of the surplus capital available for investment in other types of enterprise, especially in industry. Yet a third influence making for a more speedy transformation of the Pennsylvania economy was the rapidity of population growth and its expansion into the interior. Penn's policies of religious toleration combined with other things to lead more people to come to colonial Pennsylvania than to any other single colony. An abundance of land at reasonable prices encouraged rapid growth of interior settlement. This meant that in Pennsylvania internal trade early began to compete with foreign trade in importance, and a general stimulation to economic growth was provided.

As I have pointed out in my work, *Pennsylvania, Titan of Industry*, it seems to me that our commonwealth may well claim to have been the mother of the industrial revolution. The first joint-stock company for textile manufacturers was organized in Philadelphia in 1775 as The United Company of Philadelphia for Promoting American Manufacturers. It was headed by Samuel Wetherill and its "factory" was situated on the southwest corner of Ninth and Market Streets. It operated for two years, when it was closed by the British occupation. In 1778 it was re-organized as the Pennsylvania Society for the Encouragement of Manufacturers and the Useful Arts, with Wetherill and Tench Coxe as the principals. It soon had four jennies with over two hundred spindles, a carding machine, and twenty-six power looms in one central factory, and was manufacturing cloth by thousands of yards. It was the offer by this society of prizes for new processes and machinery which originally attracted Samuel Slater to leave England for America. Arriving at New York and intending to come to Philadelphia, Slater learned of the enterprise of Moses Brown in Providence, Rhode Island, and was attracted there. Brown's factory is often acclaimed as the birthplace of the industrial revolution in America, but it should be clear that earlier evidences of factory enterprise in textile manufacturing can be observed at Philadelphia.

The economic power of Pennsylvania developed with tremendous impetus from the end of the Revolution to 1850. For all but a decade of the period it was the leading agricultural state in the union. This may seem to have little bearing on industry, but it has much to do with the growth of manufacturing. In the first place, the wealth coming from the disposal of Pennsylvania wheat, livestock, and other farm products provided part of the market for manufactures. It helped Pennsylvania farmers to break away from a self-subsistence economy and become full partners in a developing economy. In the second place, much of the early growth of manufactures was based upon processing products of the land, such as grains and timber. By 1820 the milling industry had become the most important in the state, as measured by the dollar value of the product. As late as 1870 Pennsylvania was the second state in the union in milling. The milling industry was one of the first to experience technological change, thanks largely to the



MODERN HIGH-SPEED ELECTRIC LOCOMOTIVE

Courtesy Pennsylvania State Department of Commerce

genius of Oliver Evans. The whole milling industry was revolutionized by Evans. In 1785 he perfected a completely mechanical mill with elevators, hoppers, drill, and descenders, And all were power driven. In 1795 Evans published his famous book, *The Young Mill-Wright and Miller's Guide*, which became the standard guide to milling operations for a generation or more.

The important leather industry of 1850 was likewise based upon an agricultural resource. The story again was one of mechanical improvements. The old-style tannery was simple. It consisted of a few wooden vats sunk in the ground and perhaps a shed or two for bark and hides. By 1860 the business in the larger tanneries was almost entirely mechanized and new machines for splitting and treating leather and many new and specialized types of leather manufacture were underway. Philadelphia was one of the great leather manufacturing centers of the nation by 1850 and famous especially for its fine morocco leathers. Philadelphia was also one of the centers of the infant industry of processing and manufacturing foods.

Since colonial days, the Quaker city had been a hub of the printing and publishing industry. It still held this position in 1850 and enjoyed leadership in mechanical developments. Adam Ramage in 1818 developed an improved type of printing press known as the Ramage Press, which became famous throughout the country before the development of power presses. The Columbian press, invented by George Clymer of Pennsylvania, was the first to print two sides of a newspaper at one time. In processes of engraving and of bookbinding, the state also led as a result of Philadelphia's position.²

The most revolutionary change in Pennsylvania industry, at least in terms of its importance to the general progress of the nation, was in the iron and steel industry. The iron industry mentioned earlier was the charcoal furnace variety. While it had expanded and had grown larger, and rolling and slitting mills had developed to further refine the product of the furnaces and forges, no material revolution had taken place prior to about 1840. The complete revolution of the business of making iron was presaged in the autumn of 1836, when one Dr. Frederick W. Geissenhainer, a Lutheran clergyman by origin, first successfully produced pig iron using anthracite coal as a fuel. His experiment was conducted in Valley Furnace, about ten miles northeast of Pottsville. By 1839 the Geissenhainer process was producing iron commercially and the entire anthracite region and the areas adjacent thereto in terms of carriage of coal by canal were blossoming with the new type furnaces. Technological advances were reported almost at once as the industry developed. These included the use of steam, improvements in the design and efficiency of the blast apparatus, and a better iron as a result. By 1850 the production of iron from the new anthracite furnaces was ahead of charcoal iron, and ten years later the latter product was hardly in the running.³

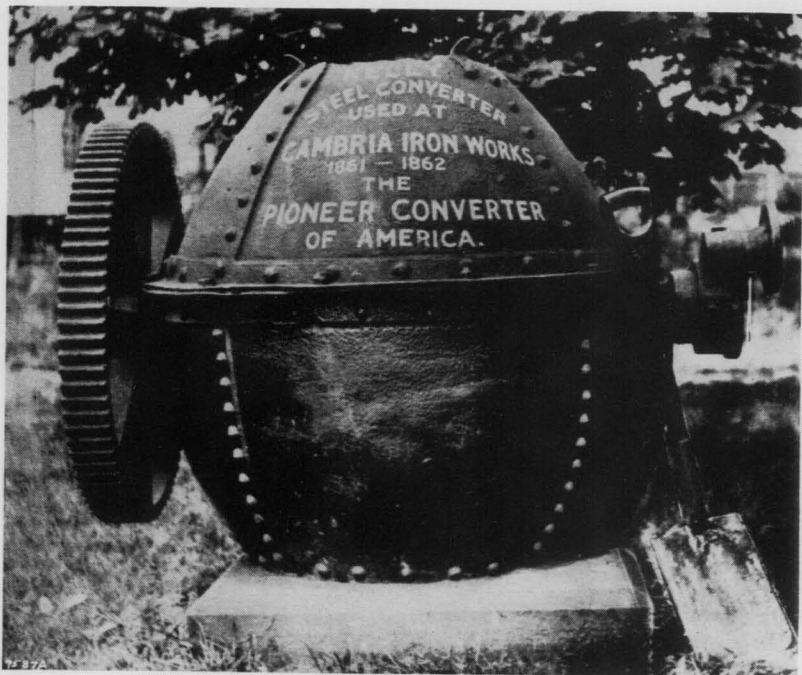
The great importance of the revolution in making iron was not in processes but in the use made of the product. There is a peculiar relationship of events in history. California's gold rush

² E. T. Freedley, *Philadelphia and Its Manufactures* (Phila., 1859), is a most valuable contemporary description of Philadelphia industrial development in the 1850's.

³ J. M. Swank, *Introduction to the History of Iron Making and Coal Mining in Pennsylvania* (Phila., 1878).

made available facilities for the financial support of a complete revolution in industry. The opening of Pennsylvania's petroleum reserves at Titusville in August, 1859, by "Col." Edwin Drake furnished the lubricant necessary for a machine age. The new era of railroad transportation was dawning, and Pennsylvania already had more mileage than any other single state. The first of the new iron T rails fully used by the new railroads of America were rolled at the works of the Montour Iron Company at Danville on October 8, 1845. The first of the new 30-foot rails of the same type were rolled at the same plant in 1859 for use on the Sunbury and Erie. The Lackawanna Iron Company at Scranton rolled the T rails utilized on the Erie Railroad when its line was building westward from New York. Thus the new anthracite iron was put to work building America's railroads.

The change foreshadowed by the new process of making iron



KELLY STEEL CONVERTER

Housed in the Johnstown office of the Bethlehem Steel Co.

Courtesy, Bethlehem Steel Co.

was the prelude to a still more important development—the making of steel. William Kelly, Pittsburgh Irishman, was the contemporary of Sir Henry Bessemer in the development of the modern blast furnace method of making steel. Kelly's process was patented in 1857 and his first experiments conducted at Johnstown at about that time. In 1861-62, Kelly succeeded in making steel in a small rotary-type converter at Johnstown and further contributed to the birth of the steel industry. The Cambria Iron Works at Johnstown also was the place where the first steel railroad rails were rolled on order in the United States in August, 1867. The steel for these rails had been rolled at the Pennsylvania Steel Company plant at Harrisburg, one of the first Bessemer blast furnace operations in the country.⁴

The new facilities for making iron made possible a great growth of the manufactures based upon iron. Foundry iron work involving the casting of iron was one of the state's most important industries by 1850. Pittsburgh was the great foundry center for the West by that date and supplied all manner of iron products. Philadelphia was another major center of the foundry business and ship-bed-plates weighing as much as forty-five tons, the marvel of the age, were cast in its foundries. Closely associated with the same industry was the machine and tool business.

By 1850 Pennsylvania was fast becoming a leading tool maker for the entire nation. Alfred Jenks & Son in Philadelphia was possibly the nation's leading manufacturer of improved cotton mill machinery and dated its activities back to 1810. By 1866, the Baldwin Locomotive Works had turned out Number 1500, and established its position as one of the world's leading builders of steam railroad locomotives. William Sellers & Co. and Bement & Daugherty in Philadelphia were among the major machine tool builders. A. L. Archambault was a principal builder of portable steam hoisting and pumping engines and perfected the Archambault portable engine.

The Sellers Company, already mentioned, was one of the largest and best known manufacturers of mill gear, shafts, and couplings and was responsible for inventing and making a new type ball and socket hanger for use on shafts requiring bearings, and

⁴ J. M. Swank, *History of the Manufacture of Iron in All Ages and Particularly in the United States and Canada to 1891* (Phila., 1892).

other like devices. The Port Richmond Iron Works of I. P. Morris & Co. built engines for some of the principal industrial and government installations of the period. The Southwark Foundry of Merrick & Sons built the great iron pile lighthouses guarding the Atlantic coast along its Florida extent, and engines for ships of the U. S. Navy. Sugar machinery for West Indian mills was made largely in Philadelphia.

Philadelphia likewise by 1850 had established a reputation for the variety and the quality of its production of tools and hardware. "Every country merchant, as well as every wood-worker, is familiar with the excellence of Rowland's Saws, Cresson's Saws, Disston's Saws, and Conway's Saws," wrote Freedley, the historian of Philadelphia industry of the 1850's. The Rowland Works was among the oldest in the nation specializing in saw manufacturing. The Keystone Works of Henry Disston, a poor immigrant of a few years earlier, was by the time of the Civil War without question the largest saw and tool manufactory in the United States. An inventive genius, Disston perfected several new saws and tools made by his firm. The erection of the new rifle factory of Sharps and Company in the 1850's gave the nation one of the largest of its arms manufacturing plants just in time to help supply the Federal forces in the Civil War.⁵

Along with the development of such industries went many others far too numerous to mention. By the 1850's one of the dominant characteristics of Pennsylvania industry, still much in evidence, was the diversity of its manufactures. Almost everything that was being manufactured in the United States was made in some form somewhere in Pennsylvania. By 1850, the pattern of industrial location had been rather clearly established. Of the major industrial areas in the state today, all were either well established by 1850, or beginning to show signs of industrial concentration. Erie, Scranton—Wilkes-Barre, and the Johnstown—Altoona districts were not as yet major industrial centers but well started in that direction. Allentown—Bethlehem—Easton, Reading and the Schuylkill Valley, Lancaster—York—Harrisburg, and the cities of Philadelphia and Pittsburgh and their environs were well advanced industrially by 1850.

⁵ See Freedley, *op. cit.*, for most interesting observations on these and other Philadelphia factories.

It is agreed generally that one of the most vital foundations of Pennsylvania's industrial growth has been its great store of natural resources. The era of expanding use of these had just started to make itself really felt as a factor working toward fuller industrialization of the state by 1850. Prior to this date, iron ore and products from the forests were the major natural resources utilized in industry. The state's great iron industry rested upon these basic resources, plus limestone. Pennsylvania provided the nation with more than half its iron ore by 1850, and continued to do so until the opening of the great ore reserves in the Lake Superior region about 1890. The rich forest reserves were a source of the charcoal for the old-style charcoal iron furnaces. The forests also provided the material for the great lumber industry, in which Pennsylvania was likewise a leader by 1850. The great coal reserves of the state had not been used to any extent before 1840. It was about that time that the Blossburg, Broadtop, and Clearfield bituminous coal fields in central Pennsylvania began to be opened commercially. Total bituminous production in the state in 1820 had been a meagre 225,600 tons, but by 1860 it had risen to nearly five million tons. Bituminous coal was now being used to make coke and the first recorded use of coke in making iron was at Pittsburgh in 1859. The use of anthracite was behind that of bituminous coal. In 1820 the state mined a mere 4,065 net tons of anthracite, but the amount rose to some 13 million tons a year during the Civil War.⁶ As has been mentioned, in 1859 the petroleum reserves of the state were tapped for the first time with a drilled well at Titusville.

Progress in transportation is the lifeline of industry at all times, and the situation in 1850 was no exception. A powerful stimulant to constant improvement of transportation in the state was provided by the practical necessity for Philadelphia to keep its trade lines open into interior Pennsylvania. This urge lay behind the building of America's first turnpike road, the Philadelphia to Lancaster pike, in 1794. It was back of the building of the first canals and the canal craze prior to 1840. Because canals soon passed out of use, their importance has been neglected.

⁶ *Pennsylvania's Mineral Heritage* (Dept. Internal Affairs, Harrisburg, 1944). See also Howard N. Eavenson, *The First Century and a Quarter of American Coal Industry* (Baltimore, 1942) for details.

Actually, they moved hundreds of thousands of tons of goods and contributed to the foundations of industrial strength evident by 1850. Then came the iron horse and by 1860 Pennsylvania led the states with 2,598 miles of railroad. Not only was there increased mileage but major technical improvements. The flat bar rails had given way to the iron T rail. Sleepers or ties had changed from dressed stone to wooden cross-ties. Improvements had been made in grades and in laying out curves. Stone ballast had come into use. In all of these engineering advances Pennsylvanians had led the way. Moncure Robinson, builder of the Reading and with a finger in almost every railroad pie of the era, has been well called the "father of railroad engineering in America" because of his many contributions. William Jackson Palmer of the developing Pennsylvania system had made pioneer experiments in the use of coal as a fuel for locomotives. Frank Thomson of the same road had developed systems for the repair and maintenance of railroad equipment which became standard practice throughout the nation.

All in all, the Pennsylvania of 1850 was a picture of a virile, new, aggressive, expanding industrial commonwealth. The new machines and equipment and the new engineering problems presented by them had created a new age of technology. It demanded the skills and the training to be provided by the new schools of technology and engineering which began to appear to serve the new era. It was no accident that such schools as Spring Garden Institute, a new Philadelphia technical school, were founded in or about the year 1850. That was a year of decision, in terms of the future of the machine age. Philadelphia was a good place to start, for here a spirit of practical scientific inquiry and of active invention had flourished since Franklin's time. It was the seat of the great American Philosophical Society which, through its committees, awards, and studies, had provided so much encouragement to the practical advance of science. The very purpose of the new Institute to fit students for jobs in the new industries of the day was in keeping with the old Quaker philosophy of working while you learn and learning through practical activity.⁷

But the year 1850 was only a herald of things to come. The age of domestic manufactures in the home and of self-subsistence

⁷ *A Century of Service, 1850-1950* (Spring Garden Institute, Phila., 1950).

was gone. In a few short years the nation was plunged into civil war. Pennsylvania industry and leadership played a decisive role in the victory of the North over the South. At the same time, the war gave a boost to the industrial expansion of the state. The capital investment in industry nearly doubled from 1860 to 1870. The number of wage earners increased by nearly a hundred thousand and the number of establishments by some 14,000. The technological revolution was continuing but not completed. In 1870, Pennsylvania industry was still using 7,603 water-wheels producing 141,982 horsepower. There were fewer steam engines used than water wheels, only 6,230; but they produced 221,936 horsepower. Pennsylvania, however, had more steam horsepower and less waterpower employed in its industries than New York. Another evidence of change indicated by 1870 was a marked trend toward the decline in importance of these industries based upon processing products of the farm and forest. Milling and lumbering were beginning to weaken as dominant industries. The most marked growth was evident in the production of iron and steel related manufactures. The age of "heavy" industry was on the way.⁸

The years to 1900 may be termed the "golden age" in Pennsylvania industry. The internal combustion engine was developed and the age of electricity on the way by the turn of the century. The machine age came into its own. The large mill and factory employing hundreds of people replaced the small brick, stone, or wood-frame factories and mills common to the early industrial revolution and the birth of the factory. It was an age when natural resources began to really provide a source of power. Anthracite production had risen to 57,367,915 tons and it had become a major fuel resource. Bituminous coal had become more important and its production in Pennsylvania had mounted from 9,000,000 to 79,842,326 net tons in the thirty years from 1870 to 1900. Connellsville coke was becoming an important fuel, and the beehive type ovens in western Pennsylvania by 1900 were turning out millions of tons of coke to make up, at one time, more than eighty per cent of the nation's total. Petroleum was coming into wider use in industry, though by 1890 about seventy-five per cent

⁸ S. K. Stevens, *Pennsylvania, Titan of Industry* (N. Y., 1948).



"STEEL VALLEY" AT PITTSBURGH

Courtesy Pennsylvania State Department of Commerce

still went into illuminating oil. The thousands of barrels of lubricating oil were very important, however, to the wheels of industry.⁹

During the era from 1870 to 1900 Pennsylvania enjoyed its greatest relative dominance as an industrial state. Pennsylvania was the second most important state industrially in the period, and Philadelphia until 1899 enjoyed the position of the nation's second industrial city. At the turn of the century, Philadelphia lost this honor to Chicago by a small margin. The period was marked by a rapid advance of Pittsburgh to a position of fifth among the industrial centers of the United States, outdistancing both St. Louis and Providence after 1870. The era was notable for the large percentage of increase in the number of industrial establishments. By 1900 the percentage of wage earners in manufacturing in the state had increased to 11.6 per cent, as compared with 6.3 per cent in 1850. The number of mills and factories had more than doubled from 1850 to 1900, an increase from 21,605 to 52,185. The average number of wage earners had grown from 146,766 to 733,834 in the same period. The number of wage

⁹ See *Pennsylvania's Mineral Heritage*.

earners in industry had grown five times, as contrasted with less than three times for total population.

This was the era of labor organization. The nation's first efforts at trade unionism had been undertaken in Philadelphia in the 1830's, and labor began to assume a new class status and to work to protect and advance its interests. One of the first successful efforts at national labor organization was the founding by William Sylvis of the National Labor Union just after the Civil War. Sylvis, a Pennsylvanian, was a leader in the Baltimore Labor Congress in 1866, and two years later was elected president of the national organization he had helped found. The successor to Sylvis as a national labor leader was Uriah Stephens of Philadelphia. Stephens was one of the leaders in organizing the Knights of Labor in 1869, and its first Grand Master Workman. His successor as leader of the Knights was Terence V. Powderly of Carbondale and Scranton. Powderly headed the Knights from 1879 to 1893. When the Knights of Labor fell into disrepute, it was followed by the American Federation of Labor, which was organized at a meeting in Pittsburgh in 1887.

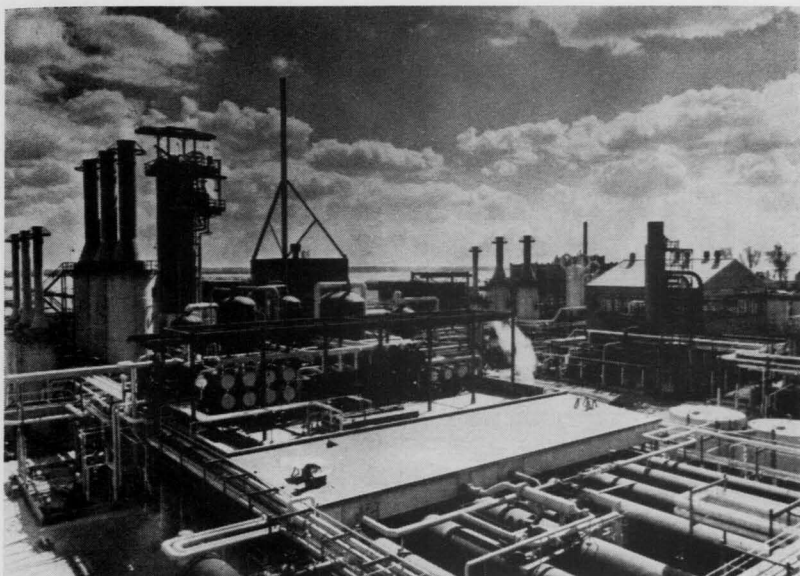
The period prior to 1900 saw a continuance of Pennsylvania leadership in technology and management in industry. It was noticeable especially in the steel industry and railroading and related activities which placed a premium upon continued technical advances. William Jones, better known as "Captain" Bill Jones, has been called the mechanical genius of the American steel industry. His many inventions before his accidental death in 1889 included the Jones Mixer for mixing molten iron from the blast furnace for the converter. William Metcalf of Pittsburgh was perhaps the father of the crucible steel industry. His *Steel: A Manual for Steel Users*, published in 1896, was one of the standard treatises of the time. Robert Sayre and Charles M. Schwab were other dominant figures in the new steel industry. Horace See of Philadelphia was one of the leading marine engineers and architects of the period from 1850 to 1900 and largely designed and built the "New Navy" of the United States in the 1880's. The William Cramp Company under William Cramp and Charles H. Cramp was not only a leading builder of naval and merchant marine vessels but the Cramp family led in the entire field of marine engineering and design.

Coleman Sellers of Philadelphia was consulting engineer on the great hydro-electric power development at Niagara Falls. John R. Roebling and his sons were pioneers in making wire rope and in applying it to the design of some of America's greatest bridges, notably the famous Brooklyn Bridge in New York. Pittsburgh's George Westinghouse hardly needs mention as one overshadowed only by Edison in the story of the birth of the new age of electricity. Westinghouse's development of the alternating current method for transmitting and using electrical energy revolutionized the use of electricity. His famous air brake likewise revolutionized railroading and made possible modern trains with their tremendous freight-carrying capacity. Edward Acheson invented carborundum as an industrial abrasive and developed the use of graphites for electrodes, crucibles, and lubricating purposes. Charlemagne Tower and Henry Oliver, both Pennsylvanians and from Philadelphia and Pittsburgh respectively, were instrumental in developing the Lake Superior iron ore ranges for utilization by the rapidly developing steel industry.

Mention has been made of the fact that the trend of industry in Pennsylvania after the Civil War was in the direction of heavier types of manufactures. By 1900 nearly one-fourth of Pennsylvania's industrial production was iron and steel and the state was making more than half the nation's steel. The whole industry had been revolutionized since the Civil War and modern large scale enterprise and technology had come to dominate the scene. The Bethlehem Steel Company, organized in 1893, was in a short time the largest independent steel company in the world. The open-hearth process for making steel had been utilized successfully in 1888 at Carnegie's Homestead Works and was soon to compete vigorously with earlier methods. Crucible steel production had started by 1900. Ninety-five per cent of the nation's steel rails were being rolled in Pennsylvania mills. The first tin plate had been made at Pittsburgh under the direction of Welsh workmen in 1872, and by 1900 the state led in manufacture of tin and terne-plate.¹⁰

The textile industry, centered in Philadelphia, remained in 1900 the second most important industry in the state, and Pennsylvania

¹⁰ See also Arthur C. Bining, *Pennsylvania's Iron and Steel Industry* (Gettysburg, 1954).



OIL REFINERY AT MARCUS HOOK, DELAWARE COUNTY

Courtesy Pennsylvania State Department of Commerce

was the nation's second largest manufacturer of textiles. At the turn of the century silk was the leading textile product, with Philadelphia, Scranton, Allentown, and Easton as centers. The cotton goods industry was centered at Philadelphia and Chester. By 1890, Scranton had become noted for its manufacture of lace. Pennsylvania still held second rank in the nation's woolen manufactures in 1900 and its percentage of the national output had increased since 1890. The Quaker State was first in making carpet and second in the making of hosiery and knit textile goods.

The distribution of manufactures in 1900 still followed patterns rather well outlined in 1850. Sixty per cent of all manufactures was made in sixteen cities. However, a trend toward some decentralization was evident because only forty-seven per cent of the state's factories was in these cities in 1900 as contrasted with sixty-one per cent in 1890. The growth of manufactures in the older cities, notably Philadelphia, was slowing down by 1900. It was increasing in younger cities such as Erie, McKeesport and Pittsburgh suburban areas, Reading, Harrisburg, and Allentown.

Pennsylvania, with its heavy industries, was in the forefront of the tendency toward the development of "big business." When the census of manufactures in 1900 endeavored to gather information on business consolidations, it was found that the largest number of big business combinations was based in Pennsylvania. Forty out of one hundred and eighty-five consolidations in business had been in the iron and steel industry. More than three hundred Pennsylvania plants were involved in consolidations before 1900, far more than in any other single state. The production of glass, bituminous coal, refractories, and the manufacture of sanitary and plumbing equipment were fields where consolidation was evident outside the steel industry, and all of these industries had strong Pennsylvania connections.

The industrial trend of the last fifty years in Pennsylvania is full of importance to the future of the commonwealth. Pennsylvania is in the twentieth century one of the older states industrially. Its rate of relative industrial growth has been behind the national average because of this fact. For example, from 1899 to 1914 the average growth in value added by manufactures in the nation was 5.02 per cent, while in Pennsylvania it was only 3.58 per cent. Since World War I the rate of growth of manufactures in Pennsylvania has been about half the national average. Of course this does not mean that Pennsylvania has stood still, because its total production of goods has been increasing all the time. Its industrial production in 1947, for example, was more than twice that in 1929, as measured in dollars. The amount expended for wages and salaries has increased also and reached a peak during World War II. Certain new industries, notably the production of food products, have shown a remarkable expansion. In general, the rate of growth of certain older industries such as iron and steel and textiles has slowed down because of increased competition from other areas of the nation. The steel industry has been moving westward and textiles have moved south in the twentieth century and this has meant a certain relative decline in the importance of Pennsylvania. At the same time, Pennsylvania has not become the seat for major new industries such as production of automobiles and aircraft. The relative decline of the Pennsylvania

coal industry, which long since passed peak production, has been another noticeable aspect of the state's industrial position.¹¹

From the viewpoint merely of statistics, one can paint a very dreary picture of the more recent industrial development of Pennsylvania. If a more realistic and practical view is taken, the situation is not as bad as it might appear. In fact, there are definitely encouraging features. The diversity and balance of Pennsylvania's industrial production is certain to be in its favor in the future. Boom conditions produced by new industries or by wars are less apt to produce sudden new industrial wealth. At the same time, they will not by their presence create problems of large scale unemployment when booms collapse or wars end. A slower and more stable industrial development is guaranteed for Pennsylvania. While the state may not build automobiles, it is becoming an important assembly center for them. The fact that Pennsylvania manufactures so many things means that it is not easily influenced by ups and downs in particular lines of industrial activity. The iron and steel industry is still paramount in importance to the state and is apt to continue in this position despite an earlier trend out of the state. Utilization of South American and Canadian ore resources promises to bring more rather than fewer steel plants to Pennsylvania. The food industry has become the second most valuable in the state, with textiles third. Modernization of machinery and techniques promises a recovery of the textile business to perhaps a stronger position. The manufacture of chemicals, including oil refining, is the state's fourth industry in value of product, and this is a stable and advancing type of production. The printing and publishing industry ranks fifth, and it too is a stable business not subject to violent fluctuations.

Many other factors are in favor of the continued importance of Pennsylvania as an industrial center. Its population still is growing, and it continues to possess the diversity of talents and skills which has characterized it since William Penn's time. Pennsylvania produces more of the mineral wealth of the nation than any

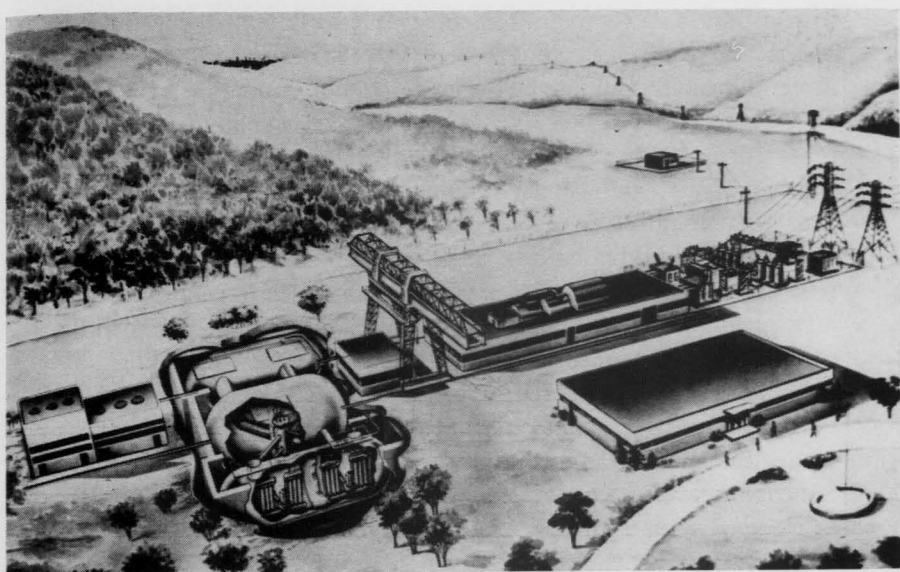
¹¹ See Carl W. Hasek, and others, *Industrial Trends in Pennsylvania Since 1914* (State College, 1942); *Pennsylvania's Industrial Economy* (Joint State Government Commission, Harrisburg, 1949); *Preliminary Report Pennsylvania State Planning Board* (Harrisburg, 1934); *Monthly Business Review* (Federal Reserve Bank, Cleveland); *The Business Review* (Federal Reserve Bank of Philadelphia).

other one state. Nearly 18 per cent of all the nation's mineral production in the last thirty-five years has been from Pennsylvania mines, quarries, and oil wells. It still leads the nation in coal production. It makes more coke from coal, and has rich chemical by-products from this process. In the total production of fuel energy to operate transportation and turn the wheels of industry, Pennsylvania also leads all the other states. It is the second largest producer of electrical energy by public utilities and the largest producer of non-electric energy. It leads in electrical energy generated from coal. Pennsylvania coal helps produce power far outside the state's borders. Pennsylvania also produces more than ten per cent of its electricity from water driven generators, as compared with 2.6 per cent for the nation.

The facilities for transportation and communication in the state are also well developed. This is important because they are life lines of modern industry. The state has the third longest railway trackage, of over eleven thousand miles. Its railroads carry more freight than those of any other state. In water-borne commerce Philadelphia is still the second port on the Atlantic Coast, while Pittsburgh is the nation's busiest interior river port. Erie is an important lake port. The highway system of the state is a billion dollar one, covering some 100,000 miles. Pennsylvania has more state highways than all the rest of the northeastern states combined.¹²

Not only are there abundant transportation facilities, but the state government is placing every energy behind the development of industry. The Department of Labor and Industry was created in 1918 to exercise certain functions in the industrial field. The Department of Internal Affairs has a statistical service for industry and seeks through its work to provide conditions favorable to industry. More recently, in 1939 a Department of Commerce was established to aid in state planning and to encourage new industry for the state. The current programs of highway improvement and stream sanitation are developments which should serve to im-

¹² For recent statistical data conveniently organized consult *The Pennsylvania Manual* for 1949-50 and 1951-52; *Thirteenth Industrial Directory* (Dept. of Internal Affairs, Harrisburg, 1953). *Delaware Valley, U. S. A., 1953* (Philadelphia Inquirer supplement, Sept. 29, 1953) and *A Record of Accomplishments of the Fine Administration* (Governor's Office, Harrisburg, 1954) are useful for very recent information.



ARTIST'S SKETCH OF ATOMIC POWER PLANT

This is a preliminary artist's sketch of the nation's first atomic powered electric generating station which is to be built at Shippingport, Pa., near Pittsburgh, as a joint project of the U. S. Atomic Energy Commission and the Duquesne Light Company. Westinghouse Electric Corporation is developing and building the reactor portion of the plant under contract to the AEC. The Duquesne Light Company will design and construct the turbine generator portion and will operate the plant.

The plant components depicted are, from the left: a building for fuel handling, the atomic reactor and heat exchangers, the maintenance building and overhead traveling crane, the turbo-generator building, the switchyard containing transformers and circuit breakers, and transmission lines. In the right foreground is a building containing shop and administrative facilities.

As can be seen from the cutaway view, the atomic reactor which provides the heat, and the heat exchangers which generate the steam, will be located underground in concrete and steel structures. These underground structures will provide protection to operating personnel and the surrounding area in addition to the many protective devices in the reactor itself. The large central underground structure houses the reactor itself which is located within the vertical, cylindrical container which represents the pressure vessel. Water under pressure is pumped through this vessel. It is heated and is pumped to the four heat exchangers, two of which are visible in the cutaway foreground. The other two are in the horizontal cylindrical structure to the rear. Heat from this pressurized superheated water converts other water in heat exchangers to steam. The steam then is piped to the turbo-generator. This pioneer nuclear power plant will produce a minimum of 60,000 kilowatts of electricity.

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prove the state's industrial potential. Recent statements of Governors Duff, Fine and Leader indicate the determination of Pennsylvania to assist local communities to work with their industries and to seek new industrial opportunities.

Especially encouraging is the fact that these plans are producing results. Reports of the Bureau of the Census for 1949 indicated that Pennsylvania led all other states in the amount of moneys spent on new plants and equipment. In 1948 alone, more

than a thousand companies spent over two billion dollars on new plants and equipment in the Keystone State. In 1946-48 nearly three thousand new manufacturing establishments started production in Pennsylvania, including several nationally known manufacturers such as the Butterick Company, General Motors, Auto-Lite Company, and Bundy Tubing Company. In 1951 and 1952 over eight hundred new manufacturing industries were started in the State. Pennsylvania has led the nation in plant expansion the past three years. Old companies, some of which have an industrial history of more than a century in the state, have been expanding operations. Companies large and small have been spending large sums to develop their productive facilities in Pennsylvania. More than a billion was spent on plant expansion in 1952. This speaks louder than words as to the prospects for the industrial future of the commonwealth. As of 1952 there were 20,822 industrial plants in Pennsylvania with 1,799,529 employees.

An increasingly important role in the future of Pennsylvania industry is certain to be taken by the schools and institutions equipped to provide technical training. The diversity of our industry is one reason for this situation. An even more important factor pointing in the same direction is the need for new types of industrial enterprise in the state to take the place of the old. Yet a third reason is the practical fact that much of the ability of Pennsylvania industry to survive and progress rests upon its ability to modernize in terms of machinery and processes, and to develop new and more efficient methods of production. As an older state, we are in competition with younger industrial areas. This places a premium upon technological improvements and trained personnel as a means of decreasing production costs and improving the quality of products which enter into competitive markets. The facilities for technical training and leadership were never more important to the state and might decide its industrial future. The Pennsylvania of today is quite different from that of 1850, but some of the basic needs of its industries have not changed as much as we might think. History provides hope for continued industrial leadership by Pennsylvania despite temporary regional or seasonal declines which plague the State from time to time.