

## CHARLES E. SMITH.

HIS RELATION TO THE AMERICAN IRON INDUSTRY.

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The Franklin Institute, in its three-quarters of a century of active life, has numbered among its members many men whose names will remain inseparable from some of the most important inventions and discoveries of the nineteenth century. We, their successors, are proud of their achievements; but, in these later days of technical schools and industrial progress, we can have little conception of the difficulties

*Charles E. Smith*

under which they labored in working out the problems which they solved. Nor do we duly appreciate the tremendous influence which the Institute has exerted through all the period of its existence, during a large portion of which it was the chief, and almost the only source of technical information. How great that influence has been can never be known.

Among those who have attained to eminence in particular industries or public station many were, in early life, constant attendants at the meet-

ings of the Institute and drew inspiration from the bright intellects whose recorded thought is now a priceless heritage. Although they did not become prominent in the work of the Institute, they went into the world equipped with the knowledge which brought them fame and fortune.

Among these, the late Charles E. Smith, President of the Philadelphia & Reading Railroad Company, was a notable example. Mr. Smith is best known to the older members of the Institute and to the public generally as the capable engineer and financier under whose brilliant management

the Reading Railroad, a defaulting corporation, was brought up to a state of physical efficiency and financial prosperity until then unexampled in the history of railroading. The golden age of that great property is spanned by the period of his presidency. His career as president, from 1861 to 1869, stamped him as a railroad manager of the first rank, a far-seeing financier of unflinching integrity, and as a patriot who fearlessly supported his government in the most critical period of its existence, with the very essential aid of the property under his control, while the most powerful interests conspired to defeat his purpose.

Few of the members, however, knew what Mr. Smith's relations were to the infant iron industry of this country, which has grown to such proportions that it has outranked every other, and has made America the first among nations. The history of the marvellous progress of metallurgical science can be read in the recorded transactions of the Institute, but it is fitting that a chapter should be added to show how the scattered energies and diverse methods of the early American workers in the art of iron manufacture were organized in the interest of scientific and financial success.

Born in Philadelphia on November 1, 1820, educated at West Town School and brought up in the principles and faith of the strictest sect of the Society of Friends, Charles E. Smith commenced the practical work of his life at the age of eighteen years as a member of an engineering corps, engaged in the laying out and construction of a railroad in Tioga County, Pa. When it was completed he was appointed Superintendent, and also had supervision over the Blossburg Coal Mines, whose product the road was built to transport. Thus, right at the beginning of his business career, he was called upon to assume the duties of administration, as well as the technical work of a civil and mining engineer. The six years spent in that region were valuable in experience. There he formed that habit of quick decision and prompt execution which characterized all his later business career. His orders were imperative and permitted neither of modification nor delay in their execution. This was the natural outcome of supreme authority en-

trusted to one so young, and his appointment at that age was an evidence of the recognition of his ability by those who placed him in that position.

He returned to Philadelphia in 1844 to seek a wider field for his energies. He had seen enough of the natural resources of the State to convince him that the iron industry must become an important one. Bar iron, rods and rails were then nearly all imported, and the transportation facilities were very meagre. After studying the subject for a year or two, he designed, and in 1846 built, the Fairmount Rolling Mill, whose site on the Schuylkill River above Fairmount Avenue, at the foot of Lemon Hill, is now occupied by the Lincoln Monument. The Reading Railroad on one side and the boats of the Schuylkill Navigation Company on the other gave ample facilities for the transportation of materials and products.

Mr. Smith's connection with the manufacture of iron extended over a period of about sixteen years, from 1845 to 1861, during the greater portion of which he managed his own plant. Among his contemporaries and associates during that period were Abram S. Hewitt, John Fritz, Coleman Sellers, James Moore and Washington L. Jones, to all of whom the writer is indebted for information as to Mr. Smith's enterprise and ability, and to the condition of the iron industry at that time.

Nearly every branch of the business was then in its formative stage. The processes for the reduction of the ores, the carbonization of the iron and manufacturing it into merchantable shapes were but crude imitations of foreign methods. Experience with American ores and fuels had not been sufficient to develop the character of the one or the value of the other, and American genius had not then set its stamp upon any of the improved machinery which has since become such an important factor in the economy of production. These gentlemen unite in saying that Mr. Smith was a remarkably energetic and progressive man, and was quick to recognize the value of any real improvement and adopt it in his business. Some of these improvements were first put to use in the works under his management.

The Fairmount mill was hardly in operation before he began to make improvements in it. The late James Moore, who was called in to make some changes in the rolls, said these improvements were radical, and were great advances in the art at that time. Among these was an arrangement to use the fire from the puddling furnaces to heat the water under the steam boilers, saving not only a great deal of coal which cost more then than now, but also the handling of it. The changes in the rolls were to ensure the rolling of rods and bars true to size. It is said that the Fairmount mill was the first in this country to roll rods that the locomotive builders would be satisfied with. More than a decade after this the number of mills in the country that could roll round or square iron true could be counted on the fingers of one hand.

In those days nearly all the rolling mills had puddling furnaces and prepared their own iron for the rolls. There was little knowledge of the character of the cast iron bought from various furnaces, and only an empirical knowledge of how to prepare it for the rolls.

The best practice was to depend upon the judgment of a foreign skilled laborer. The steam hammers of the period were lifted by a cam and descended by their own weight. The Nasmyth steam hammer had, in 1846, just been brought to notice in this country through the late Samuel Vaughn Merrick, and Mr. Smith was one of the first to appreciate its value and put it to use in his mill. In this he was opposed by his partners, but his will was law, and the hammer went in with excellent results.

The mill had been running less than a year when Congress repealed the Protective Tariff Act of 1842. Mr. Smith's opinion in favor of the protection of American industries had been formed while in charge of the Blossburg Coal Mines, which had been started into activity and made prosperous by the passage of the Act. Recalling the general business stagnation, and the idleness in mine and workshop which preceded its enactment, he prophesied disaster to the iron mills by its repeal, and at once sold out his interest to his partners, who were not of his mind. It

is a matter of record that more than two thirds of the furnaces of the country were shut down within the next two years, and among them the Fairmount Rolling Mill.

For the next few years he was content to take charge of the property of other ironmasters and risk none of his limited capital. For two years he was Manager of the Renssalaer Iron Works, Troy, N. Y., which was the first rolling mill in the Empire State to make rails. It was a comparatively new industry in this country. Rails had been rolled at Mt. Savage, Md., in 1844, and the first T rails at Danville, Pa., in the same year. Cooper, Hewitt & Co., who built, and still operate, the Trenton Iron Works, rolled T rails in 1846.

They were the first in the world to make heavy rails, and rolled them up to 90 pounds per yard at that early period. One of these rails, made in 1846, was taken out of the track of the Camden & Amboy Railroad in 1898, after more than fifty years of service. Robert L. Stevens, President of the Camden & Amboy R. R. Co., put foreign made T rails into that road in 1836.

To the form, weight and stiffness of rails Mr. Smith gave much study and made some important changes in the rolls for rail making while at Troy. He became convinced, however, that the iron business could not be made successful at that place under the existing conditions, and severed his connection with the works.

Soon after, he went to Europe, partly to study the methods of manufacture and conditions of success in the various iron centers, and partly to determine whether Europe or America offered the greater advantages to a young man with limited capital. Going there well recommended, he was given abundant opportunities for collecting facts in relation to the iron business, which, with the experience he had already gained, gave him a comprehensive grasp of the whole subject. More than a year was spent in this study, and he pursued his inquiry with that zeal and careful attention to details which characterized his entire life.

He returned convinced that America offered the best

field for a young man's energies, and well equipped to meet the untoward conditions which surrounded the American iron manufacturer. He recognized the fact that, with a difference of nearly eight dollars a ton in labor cost in favor of Scotch pig iron, and a much greater difference in the labor cost of a ton of rails, the industry could not thrive in America without the fostering care of the general government. To secure that protection he bent all his energies, and on every occasion presented the data he had secured to show what might be done in the development of iron manufacture under proper conditions.

Soon after his return from Europe he became manager for Reeves, Buck & Co., in their rolling mill at Phoenixville. In the following December (1849) a convention of "Manufacturers and Dealers in Iron" was held in Philadelphia to take measures to relieve the depression of the iron interest by enforcing upon Congress the necessity for revising the tariff. The summer preceding this meeting had seen much agitation of this subject, and the names first affixed to the call for the convention were those of his employers, Reeves, Buck & Co., who were in full sympathy with the views of their manager.

Of this meeting Charles E. Smith and Nathan Rowland were secretaries. A committee on the State of the Trade and Statistics was appointed, of which Mr. Smith was chairman, and Stephen Colwell, was chairman of the committee on a Memorial to Congress. The reports of these two committees are marvels of clearness, not only in the marshalling of the facts presented but in their diction. They form an epitome of the knowledge of the iron industry of the period on both continents, and are a fitting beginning of the literature of the industry which has made America the arbiter of the world's destinies.

To Mr. Smith is due the credit of gathering and compiling these statistics with great judgment and consummate skill. He was quite willing to undertake the task of collecting the data from the scattered American manufacturers, but he had little conception of the labor and hardship which he afterward experienced in his quest for this information.

As shown in his report, he visited forty-five counties of Pennsylvania in which there were iron works, and obtained at first hand the statistics of their capacity, product and character of work turned out. When it is considered that there were but few miles of railroad in operation at that time, and that a large proportion of the forges and furnaces were inaccessible by stage lines and had but a local custom, and that only by diligent inquiry could they be located, the thoroughness with which this canvass was made, and the unquestioned accuracy of the report, must be regarded as little less than marvellous. Traversing the state three times from east to west and four times from north to south, by rail, by stage, by country wagons, on horseback and even on foot over mountains and through the wilderness, although the winter was one of the coldest of the century, he traveled over 2,500 miles and visited 504 charcoal furnaces, forges and rolling mills. The Convention had no funds. Starting with ten dollars of his own money he begged his way, paid his expenses and returned in the Spring with three hundred dollars in his pocket.

The report was made to Congress and was printed. The figures presented were drawn upon largely by the protectionist newspapers throughout the country. The Convention was chiefly useful to the iron manufacturers by bringing them to know each other and leading them to unite for the furtherance of their mutual interests. One of its most important fruits was the organization of the American Iron Association in 1855, of which Mr. Smith was elected treasurer and J. P. Lesley secretary. The Association undertook the compilation of a statistical guide to the iron works of the United States, the facts obtained being published in the Bulletin of the Association. These facts were, in 1859, presented in one large volume entitled the "Iron Manufacturer's Guide."

Of this volume, Mr. James M. Swank, the Vice-President of the American Iron and Steel Association, says: "In all this hard work Mr. Smith was the active and efficient assistant of Professor Lesley; in fact he may be said to have had from first to last, a leading share in the compilation of

the statistics gathered by the Association from 1855 to 1859. Because of this connection, and his previous work in collecting information of the iron industry of Pennsylvania in 1849, Mr. Smith was unquestionably entitled in his lifetime to the honor of being regarded as the first statistician of the American iron trade."

After lying idle for several years, the Fairmount Rolling Mill was re-purchased by Mr. Smith at sheriff's sale, and, under the name of Charles E. Smith & Co., he rehabilitated it, put in rolls for making railroad iron and also made skelp for his silent partners, Morris, Tasker & Co. He did not resume the manufacture of merchant bar, which was abandoned as unprofitable. The rails were principally light mine rails, not exceeding 50 pounds per yard. The very latest improvements were introduced and Mr. Coleman Sellers, who formed Mr. Smith's acquaintance about this time, said that William Sellers & Co. made for the mill a hot saw to cut the rails. It was one of the first to be put in use. Mr. Sellers said Mr. Smith showed much mechanical ability and seemed bent on doing the best possible with the plant, putting in not only the most efficient rolling machinery, but also other machinery to work the rails to completion.

The mill was equipped with puddle furnaces. As far back as 1846, when it was first built, the iron was boiled. Pig-iron, as it could be bought from the furnaces, was melted in deep furnaces. The molten iron was stirred, and iron scale (oxide of iron) from the mill was thrown into it; so that the output from the furnace of a good boiler would be greater than the weight of pig-iron put in. The skill of the furnaceman was best shown in his ability to collect the wrought iron in small balls, raise the heat so as to weld several of these balls into one, dip the ball out of the furnace, tilt the mass so as to let the slag run out, and do this so skilfully that the phosphorus would not be taken back into the iron. The ball was then taken to the squeezer or hammer.

About this time an automatic puddler was invented by Mr. William Sellers, but before it came into practical use the



Bessemer process was brought out, which, being a cheaper one, did away with puddling furnaces to a greater or less extent.

Improvements in the quality of the iron had been studied by Mr. Smith in an empirical way with fairly good results. The quality of the skelp made for Morris, Tasker & Co. was a matter of vital importance in the manufacture of tubes, and extraordinary efforts were made to hold their custom. They had put their money into the new venture, hoping the mill would turn out a product equal to that which they had hitherto imported. Some quite spirited discussions are said to have occurred between Mr. Smith and Mr. Thomas Tasker, the elder, in regard to the quality of the iron.

Mr. Washington Jones, of the Institute, who was a contemporary of Mr. Smith's, has a good recollection of the mills of that period. Reany, Neafie & Co., with whose establishment he was then connected, used to order iron from the Fairmount Rolling Mill. There was then but one other rolling mill near Philadelphia, that of Nathan Rowland & Co., and merchant bar only was made there. Mr. Jones made many alterations and repairs in Mr. Smith's mill while with Reany, Neafie & Co., and that firm built a 150 horse power engine for it in 1846, the first stationary engine they had ever built. The rail mill and rod mill were made by James C. Moore, the founder of the Bush Hill Iron Works. The latter rolled from  $\frac{3}{16}$  to  $\frac{5}{8}$  inches in diameter. Three-quarter and 1-inch rods were rolled by hand. It then cost \$6.50 a day for the man who run the mill, and he spent about half that time at the "Nanny Goat Tavern" on top of the hill. Truly the conditions of success in iron manufacturing were lacking at that period.

Up to the time when Mr. Smith was called to the Presidency of the Philadelphia & Reading Railroad Company in 1861, he continued to manage the Fairmount Rolling Mill, an increasing proportion of its product going to the pipe works of Morris, Tasker & Co. After disposing of his interest in the mill it was run by Charles Wheeler, one of the members of that firm.

His selection as president of the Reading was a surprise to many, but his fitness for the position was well understood by those who made the selection. In 1852 he was elected to the Board of the Schuylkill Navigation Company, and for several years was an active member of that Board. The railroad was its competitor, and the questions constantly coming up for settlement between the two familiarized him not only with the advantages possessed by each, but convinced him of the desirability of uniting the two under one management. He was essentially a railroad man, his education and experience teaching him that the canals had had their day. Under his management the union was effected, and as the canals could not be improved without necessitating the rebuilding of both canal and floating equipment, they rapidly went out of use.

The history of the Reading Road under Mr. Smith's management has no parallel in respect to improvement in physical condition, development of natural resources along its lines, discipline of organization and successful financial results. He had spent all his life in the dual position of mechanical engineer and manager, putting his own conceptions into effect and profiting by the results. He made the track a fit highway for heavy traffic, adjusted the burden to every struggling industry on his lines, and faithfully turned into the company's treasury every dollar earned by its heavily laden trains. That he should have broken down in health after eight years of such labor is not surprising. His brilliant achievements while President of the Philadelphia & Reading Railroad are better remembered after the lapse of a third of a century than his earlier work in the development of the iron industry. The former is still a brilliant memory; the latter looks insignificant when comparison is made with the little rolling mill on the Schuylkill and its antiquated methods; but when the movement to organize the iron interests, in which he was the principal factor, is considered, together with the results which flowed from it, it may fairly be questioned whether that work ought not to be regarded as being the more important one.