

"I did not know what strength we actually were reaching in this extra concentration because we were shipping all our acid to the refiners as 66°, adding enough sulfuric acid distillate to bring it back to that strength. But I had a run of acid made at the highest concentration, filled a clean tank car with it and shipped it to the du Pont Repauno works. Our chemist on testing a sample of the run found a concentration of 97.75 percent. Du Pont chemists verified this result by tests of the carload."

"Mr. du Pont promptly sent on the cigars, a superior quality, and I still have the box, though it is now 44 years old," wrote Grasselli in 1928.

This was the first sulfuric acid successfully produced and sold in the United States of a greater strength than 66°. The lower strength had been used till then by all dynamite and nitroglycerine manufacturers and the introduction of the new high strength acid was a distinct advance. Yields of nitroglycerine were greatly increased and costs cheapened.

The successful association of du Pont and Mr. Grasselli was progressing toward the establishment of even closer relations by an agreement under negotiation by Mr. Lammot du Pont that in any new enterprises in the explosives business E. I. du Pont de Nemours and Company would take a two-thirds interest and Grasselli would take the other third. The tragic death of Mr. du Pont in an explosion at Repauno, March 29, 1884, ended the project. Under the plan for the joint project, Grasselli and Mr. du Pont had bought land on the St. Lawrence River opposite Montreal as the site for an intended nitric and sulfuric acid plant which was never built, and Grasselli abandoned plans for entering the explosives field.

Lammot du Pont was esteemed by Mr. Grasselli as "one of the most remarkable men I have ever known." He records in his notes of the Grasselli company's history two remarkable exploits in connection with the Crimean War recounted to him by Mr. du Pont.

"During the war, both the French and the Russian governments came to be sadly in need of powder and both turned for their supplies, as in World War I, to the du Ponts," Mr. Grasselli wrote.

"Lammot du Pont met their representatives at Wilmington at about the same time, and even entertained both in his home, the Frenchman in one end and the Russian in the other end of the house, neither knowing the other was in America.

"Finally the Russian was the highest bidder and the agreement was made that the cargo of powder was to be delivered within the Russian lines. The British and French soon learned of the transaction and when the ship was ready had vessels of war stationed outside the three-mile limit at Hampton Roads, Virginia.

"Mr. du Pont sent out a ship similar to the one carrying the powder, and while the French and British were pursuing it, the powder ship, carrying Mr. du Pont, set sail. The voyage across the Atlantic was without incident.

"At Gibraltar, the ship lay to, until a heavy fog permitted it to slip past. Eluding capture by one means or another in the Mediterranean and the Black Seas, as the ship neared Sebastopol, blockaded by three lines of warships, they encountered the real test.

"The powder ship had obtained the code signals which carried them past the first line, but their identity was surmised and they were overhauled. Mr. du Pont ordered full steam and took charge of navigation. Shells fell dangerously close, and had one gone into the hold, the venture would have ended then and there in a flash and a roar. Shots whizzed through the rigging. But Mr. du Pont brought the ship safely through and he ran it on the beach at Sebastopol, completing one of the most perilous voyages in naval history."

For many years British manufacturers had enjoyed a virtual monopoly in the world's alkali market. American glass makers were dependent upon them for basic materials, including salt cake and soda ash. Shortly after Caesar Grasselli assumed direction of his father's company, the attractiveness of this field induced him to attempt the development of American sources of supply of these important chemical compounds.

For many years Grasselli had been making salt cake as a step in the manufacture of soda ash. But this product had never been marketed and British houses controlled the supply of it as it was used by the American glass industry. In 1885 it was decided to manufacture salt cake on a commercial scale with hydrochloric acid as a by-product of the process. Till then hydrochloric acid had been produced in ordinary cylinders and absorbed by gasses in receivers, but this limited the company to a single product and it was determined to explore the possibility of finding a market for salt cake and at the same time reduce the overhead on production of the acid.

Thomas David Owen was directed to design the first salt cake furnace set up in the Grasselli works in 1885. Owen, who had been apprenticed to the Flint Chemical Works, Flintshire in Wales, and had moved on to be head chemist of John Hutchinson and Company, Widnes, makers of sulfuric acid from pyrites, had been brought to America to become head chemist of Grasselli. He remained with Grasselli for many years returning to join his father's chemical firm in England where he was later knighted.

The furnace he designed consisted of a two-hearth, open roaster, or decomposing furnace, and a hydrochloric acid pot with absorbers in tandem coke towers 24 feet high and made of brick. Two compartments in the towers were exhausted from the furnace and two from the pot. The pot was charged with common

salt and crude nitre cake, or sodium bisulfate, a by-product brought hot from nitric acid cylinders.

Gas absorbed from the pot produced acid of fair quality, but that from the furnace was rich in sulfuric acid and other impurities. A ready market for this inferior grade was found among strawboard makers.

The grade of salt cake produced was of superior quality and its production in volume at Cleveland placed Grasselli among the pioneers in this branch of chemical manufacture in the United States. Operatives in the nation's glass factories were recruited almost entirely from England and Belgium. They were used to foreign salt cake and reluctant to use the domestic product.

H. C. Grant, then in charge of Grasselli sales, sought to interest Pittsburgh window glass manufacturers. Grasselli prices were much below those paid to British suppliers, but still the Pittsburgh glass men refused to buy, declaring their workers were prejudiced in favor of British cake. Meanwhile, with no outlet, Grasselli stocks were piling up.

Mr. Grasselli decided to undertake the education of potential consumers to the advantages of buying in the home market. He approached the Cunningham Glass Company of Monongahela, near Pittsburgh, a firm that had desired to use the Grasselli product but feared the effect of antagonizing operatives who refused to try anything new. Grasselli describing his "missionary endeavor" said:

"I took it upon myself to introduce our salt cake not to the manufacturers, but to the workmen on the plant. I went on a vacation in Pittsburgh, and through the courtesy of Mr. Cunningham, was given entrance to the plant, where I succeeded in making the acquaintance of the workmen.

"I became interested in the manufacture of window glass. A friendly relationship was established with the chief of the glass blowers who was informed that salt cake produced in Cleveland was available for their requirements, that the quality was very good and that the delays in receipt would be overcome if our product was used.

"He was converted to our salt cake after giving it a fair trial. Cunningham ordered 200 tons for a complete trial which resulted in our establishing a steady customer.

"A short while later Mr. Grant was invited to return to Pittsburgh, and, when he walked into Mr. Cunningham's office he was greeted most cordially. The glass manufacturer pointed with a great deal of pride to samples he had on his desk.

"It was the best glass they had ever produced at that plant; it was a product of Grasselli salt cake."

The Cunningham company remained one of Grasselli's best friends, continuing to purchase the entire requirement of salt cake for glass from the Cleveland plant for the rest of the glass company's business life.

The disastrous flood of the Cuyahoga River, in 1885, created a critical situation for two days at the Grasselli plant but when the water subsided it was found the buildings had escaped serious damage. The location of the buildings had been given serious consideration by the elder Grasselli, before selecting specific sites and he had inquired of all the oldest residents of the area what had been the highest levels reached by the Cuyahoga within their memories.

To the stages they indicated he added an additional ten feet of altitude for a margin of safety and at those levels erected his structures. Later construction, influenced by the fact that floods had never approximated the stages indicated by the old residents, ignored the safety factor and buildings were erected at lower levels.

About the time of the flood, Grasselli was making large quantities of sulfate of copper, sulfate of zinc, Glauber's salts, and epsom salt. On February 5, 1885, water from the Cuyahoga inundated the plant. Several lumber barges had capsized, hurling timbers into the river a short distance above the Erie railroad bridge, crossing the Cuyahoga just above the Standard Oil plant.

The heavy timbers jammed at the bridge, partially damming its flow and raising the water level till it overflowed the lower levels of the Grasselli works. At the same time, the Kingsbury Run overflowed its banks in the Standard Oil yards, upsetting oil tanks. The escaping oil soon caught fire.

Water rose to a height of ten feet in some of the lower Grasselli buildings, while those on the heights remained dry. All the soluble salts in the lower buildings were dissolved, causing heavy loss of stocks. About 5000 tons of crude nitre cake had been stored in an old ice house. All this was washed away by the tide.

As the Grasselli staff watched its precious stocks dissolving before their eyes, several fires at Standard Oil increased apprehension. The peril from the flames was averted, however, without damage to Grasselli installations and in two days the flood subsided. A chaos of wreckage had to be cleared away, however, before the plant could be restored to operation.

During the decade of the '80s Grasselli for the first time began making sulfuric acid from iron pyrites or sulfide ores as well as from sulfur or brimstone. From the days of the founder's father in France and Germany, the Grassellis as well as other sulfuric acid makers had used brimstone exclusively as the raw material for their products.

When the King of Sicily, principal source of the world's supply of sulfur, imposed an export tax on sulfur to increase his revenue, the British turned to pyrites and also to cuprous ores. American manufacturers, however, clung to brimstone, a raw material that fluctuated in price on world markets. When brimstone went up, the price of acid tagged along, too. Producers hesitated due to the outlay and effort involved in changing to a completely new method of manufacture.

During negotiations between Grasselli and Standard Oil over the renewal of the sulfuric acid contract in the early 1880's, Standard Oil served notice it would not continue using brimstone acid. They said they had found pyrites acid pure enough for their purposes at a much lower cost. They revealed that Charles Pratt had acquired the Osgood zinc works at Bergenport, N.J., and that Standard had erected a plant with a 66° acid capacity of about 17,000 tons there.

Standard told Grasselli it was not expected that Grasselli could furnish acid at the price at which they were able to produce it at their new plant where no general chemical business imposed an overhead as an extra item of cost. They made it clear that Standard would not pay 80 cents for brimstone acid plus a profit when they could make their own pyrites acid at 45 cents. A friendly overture from Standard afforded Grasselli the opportunity of going through Standard's records and plant to verify their figures of costs.

Impressed by the fairness of the offer, Caesar Grasselli took I. H. Mansfield, of Marsh and Harwood, and together they went through the Bergenport plant. They were permitted to investigate at will and were helped by Mr. Pratt's son, Charles M. Pratt.

"We had complete access to their records," said Mr. Grasselli, "and made the best of our opportunity in a plant as different from the traditional method of acid manufacture as to seem almost another line of business. I became convinced that we could so cheapen our cost of production by means of pyrites that we would have a great advantage in business we did with others than Standard."

Negotiations were concluded with a five-year renewal of Grasselli's contract with Standard under which pyrites acid was to be supplied at 80 cents, a price Grasselli regarded as a great concession to him from Standard. He felt if Standard could make acid under this cost, that Grasselli, too, should be able to do it or at any rate that Grasselli should not complain if Standard made its own acid.

Under the direction of Owen, the chief chemist, Grasselli immediately went to work changing over the No. 1 chamber system in the Cleveland plant to a pyrites ore unit. The new unit worked successfully from the start and a short time after the Standard contract became operative, the plant was supplying acid made exclusively from pyrites at a cost considerably lower than that of the brimstone product.

The problem of the organization of the family business into a corporation had presented itself to the elder Grasselli but he had never accepted the corporate form as ideal for his operations. Standard Oil, following the lead of banks and great railroads which had familiarized America with the corporate form of business organization, had formed the first of the nation's great industrial corporations. Then in 1879, on the advice of their general counsel, Thomas B. McDougall, Marsh and Harwood incorporated.

Marsh and Harwood Company was comprised of the Cleveland and Cincinnati plants and the Tremley, New Jersey, plant called the Standard Chemical Company and a half of the joint interests held in partnership with Grasselli, including properties in Titusville, Boughton, and Beaver Falls, Pennsylvania, and Olean, New York, later operated as the American Chemical and Manufacturing Company, and the Union Acid Company of Cleveland. The value of the joint interests was appraised at \$800,000.

Upon the death of the elder Grasselli, legal complications arose when the Marsh and Harwood Company found itself in partnership with an estate. Responsibilities of Caesar A. Grasselli were further complicated by the fact that he had been placed in sole charge of his father's estate for five years after his parent's death, and all members of the family looked to Caesar to manage the family's affairs. He was only 32 and had comparatively little experience in the larger financial, industrial and legal problems of business.

Throughout the elder Grasselli's connection with Marsh and Harwood, Mr. Marsh had managed their joint interests, Mr. Grasselli acting as treasurer. When Caesar assumed direction of Grasselli, he was importuned by Marsh and McDougall to incorporate the family business. The two men finally insisted that legal uncertainties of the relationship be cleared up by incorporation. Summoning his brother-in-law, Daniel K. Bailey, husband of Caesar Grasselli's eldest sister Lucretia, and his younger brother, Eugene Grasselli, to a family conference, it was determined by the three to entrust the details of incorporation to Mr. McDougall.

Within 18 months, the legal details had been completed and on June 8, 1885, the partnership of Eugene Grasselli and Sons was incorporated as the Grasselli Chemical Company, with a capital of \$600,000. And the charter of the company was filed with the Secretary of the State of Ohio on June 11, three days later. McDougall continued as general counsel of the new organization and after 1893 served as a member of the board of directors, a post he held till shortly before his death in 1899, at South Salem, Ohio.

Incorporators of the new firm were C. A. Grasselli; Eugene Grasselli; Frank K. Glidden, husband of Caesar's youngest sister, Mary; Kennedy B. Bailey; and Daniel K. Bailey. Books

were opened for subscription to the company's capital stock of \$100 par value on June 20 and ten shareholders subscribed \$489,900 for 4899 shares, of \$600,000 authorized capital.

The stockholders included the five incorporators and Caesar's five sisters: Mrs. Glidden; Mrs. Bailey; Mrs. Thomas A. Ireland, Caesar's sister, Ida; another sister, Frances, the wife of Paul F. Ireland; and Eugenia, the wife of Albert Duffill. One week later five directors were elected and they chose the following officers: C. A. Grasselli, president; Eugene Grasselli, vice-president; Daniel K. Bailey, secretary; and K. B. Bailey, treasurer. On August 19 a resolution was adopted taking over for the company the Cleveland and Cincinnati properties which up to then had been known as E. Grasselli and Sons and E. Grasselli & Company, respectively.

Two years after the incorporation of Grasselli, David M. Marsh died and was succeeded as president by his brother-in-law, H. J. Burrows. Late in 1888, the first steps toward consolidating the two firms were taken. Grasselli increased its capital from \$600,000 to \$3,000,000, and as 1889 opened the directorate was increased by the addition of nine new members: John W. Fox, Oliver F. Gordon, Frederick T. Sholes, of Marsh and Harwood, and Harry C. Grant and Edward H. Rising, two Grasselli men.

On January 24, 1889, the board approved purchase of a controlling interest in Marsh and Harwood and the Standard Chemical Company and the taking over of the property of the American Chemical Company and incorporation of the Grasselli Chemical Company of Pennsylvania to operate the latter.

As soon as possible after consolidation, equipment of the two new units in Cleveland were modernized and the plants at Beaver Falls and Titusville were improved. Before long the entire output of the expanded company was on a sulfide ore basis. The reorganization brought back to the company Mr. I. H. Mansfield, who had left Marsh and Harwood to go with Standard Oil. He took charge of western sales for the Grasselli Company and later became a member of the board of directors and the executive committee and finally in 1904 vice-president, continuing active in the company service until his death in 1913.

Consolidation of the two companies was followed within a year by abandonment of the company's properties in Cincinnati. The old plant built by Eugene Ramiro Grasselli was sold to Reinstrom Brothers, and the old Marsh and Harwood works were sold and all manufacturing there was discontinued.

Though consolidation was followed by abandonment of activities in Cincinnati an immediate result was the extension of Grasselli operations into a new industrial area. Marsh and Harwood had early seen the advantages of an eastern plant, and, organizing the Standard Chemical Company, they built on New Town Creek, near Long Island City, New York, in the early '70's, in what was already a thriving industrial community in the metropolitan district.

Their first venture was the manufacture of sulfate of ammonia, to which they soon added facilities for making sulfuric acid. The site proved ill-chosen for a chemical project, however, and a new one was shortly acquired in a district later to become one of the nation's great manufacturing areas and one in which New York chemical industries were to concentrate. Their foresight was phenomenal since few sites could at that time have seemed more uninviting. They built their plant on the Kill von Kull, opposite Staten Island, about four miles from Rahway, New Jersey, and a mile and a half from Tremley, New Jersey, then the nearest station on the Central Railroad of New Jersey.

The plant occupied a site on the shore of the Staten Island Sound three-quarters of a mile from high ground and could be reached only by boat or over a plank walk, only three or four feet above the water at high tide. The first chamber system for making sulfuric acid was set up in 1884 there, and another was soon added, both operating on brimstone. A sulfate of ammonia plant was also installed and a sludge acid works was built, but both of these proved unsuccessful and were shortly abandoned.

To construct the plant, builders had to drive piles 25 to 30 feet on which to support the structures. Pipe lines had to be supported on piles so they would not sink into the soft soil. Throughout its operation by Marsh and Harwood, the Tremley project continued an unprofitable venture and after the merger of the company's Cleveland and other plants with Grasselli had been arranged, the question of the disposition of the New Jersey works became a matter for separate discussion. Inasmuch as Tremley had shown so consistent a loss, some courage was required to decide to include the unit in the new company. On the ground that an eastern seat of operations would even the company's competitive position with relation to eastern rivals, it was finally decided to acquire Standard's interests. In view of the unsuccessful experience at Tremley, a price less than par was accepted for Standard's stock.

The site acquired by Grasselli in this deal included 300 acres and a mile and one-half of water front but gave access to no source of fresh water. All water for use in boilers and chemical processes had to be brought in wooden canal boats from Elizabethport. The boats were old and leaky, frequently 25 percent more water was pumped from them than their leaky holds had contained. The result was costly damage in burned out boilers or boiler tubes. The men had to bring their drinking water from home in earthen jugs.

More serious than these inconveniences was the lack of railroad connection to the plant. All supplies entering or leaving the plant were shipped by water. Often in winter the Sound filled with ice, and the cost of getting a lighter through to New York Bay sometimes was as great as the worth of the cargo.

The problem of a fresh water supply was solved by persuading the Elizabethport Water Company to construct a pipeline between two and three miles long into the plant. To obtain a connection with the Central Railroad of New Jersey at Tremley, the road was approached and after a survey agreed at a cost of \$5500 to build the line. Completion of this road to the point where it functioned properly required three years and the expenditure of between \$50,000 and \$75,000 by the railroad.

When the railroad line was first opened to the plant and after the first train had been run over the meadows into the works, Caesar Grasselli observed with dismay, according to his report, that the trackage had sunk for its entire length into the soft soil until the bottom of the freight cars were level with the ground..

But the railroad made good on its agreement and in time deposited ballast that supported the track. And from the time transportation by rail was provided, the plant prospered and earnings at Tremley improved. Several years later when the shore line along the Kill had been built up to the growing industrial section, the railroad proposed a line along the water front. In view of the fair treatment accorded Grasselli earlier, the company gave to the railroad a 50-foot right-of-way through its property. The railroad named the station at the company's plant Grasselli.

A year or two after the Tremley plant was acquired, Grasselli installed the first salt cake furnace there, similar in construction to the one the company had erected in Cleveland. Gottlieb Schindeldecker, foreman at Cleveland, was sent to New Jersey to place it in operation. He had been with Grasselli for thirty years and in all that time had never seen New York since his arrival in America. Upon his return to Cleveland he reported that the growth of the city had overwhelmed him, the sidewalks he found so crowded that he had been forced to walk in the streets.

The office of the Standard Chemical Company, owners of the Tremley works, had been established first in Pine Street, New York, and then moved to a building at Pearl and Wall Streets. Grasselli continued the office at Pearl and Wall for some years, moving later to the Sampson Building, a few doors away on Wall Street. Moving a second time, the offices were for a while maintained at 63 Wall Street, and then at 80 Maiden Lane. In 1917 the company opened its offices at 347 Madison Avenue, New York.

Upon taking over the Standard Chemical Company, Caesar Grasselli determined that its success was dependent upon expanding its trade beyond the three customers he found were taking the plant's entire output: Standard, Tidewater Oil and a third petroleum processor. It was

his policy to have as many buyers on the books as possible and steps were immediately taken to extend outlets. He was so successful that when Tidewater ceased taking its supplies from Tremley, production did not have to be reduced.

It was at this time that Caesar Grasselli established friendly relations with William H. Nichols, who had established an acid business on Long Island. Mr. Grasselli characterized him as one of the few manufacturers who had a thorough college and technical training. Nichols was head of George H. Nichols and Company, a firm he later expanded by consolidation of twelve companies to form the General Chemical Company which later became a part of Allied Chemical and Dye Corporation.

The decade of the '90's was to be marked by extensive expansion of Grasselli operations by the addition of an increasing variety and number of general chemical products. The period opened with the increase of the company's capitalization in 1890 from \$3,000,000 to \$7,500,000. By the middle of 1891, a plan of committee structure for the management of the business was perfected. The company had never had a general manager, its management always being vested in an executive committee elected by the directors.

The organization set up in 1891 consisted of eight committees, elected to serve under the executive committee. These committees and their chairmen were: Eugene Grasselli, manufacturing; Daniel Bailey, construction; Kennedy B. Bailey, auditing and finance; H. C. Grant, sales; E. H. Rising, mining; John W. Fox, supply; Daniel Bailey, insurance; F. T. Sholes, tank lines.

The executive committee consisted of C.A. and Eugene Grasselli; Mr. Rising; T. A. Ireland; I. H. Mansfield; H. C. Grant, and Daniel Bailey. It was shortly reduced to five members, three of them officers of the company and the other two appointed by the president from among the directors.

An example of the strides made during the 1890's was the firm's experience with chloride of zinc. The Atchison, Topeka and Santa Fe Railroad was one of the pioneers in the use of this chemical as a preservative for its ties, obtaining its supplies from Grasselli. Raw materials consisted of zinc skimmings and zinc scrap, which were dissolved in muriatic acid to form a neutral solution and then evaporated in cast iron half-cylinders where the compound was boiled to saturation and the product was run into sheet iron drums to solidify. The product was a very much discolored, black substance.

Caesar Grasselli upon visiting the World's Fair at Chicago in 1893 was attracted by an exhibit of German chemicals in which a wooden tie after 22 years use was displayed along with a large sample of the compound with which

it had been treated, chloride of zinc, but absolutely white in color. Upon his return to Cleveland he notified his production subordinates at the plant that Grasselli would have to make a white chloride of zinc if it hoped to hold the railroad tie business, and soon the A.T. & S.F. buyer, probably inspired by the same World's Fair display, insisted that their next contract specify a product of the same whiteness that had been achieved by the German firm. The existing contract had six months to run, but so great was the confidence of the Grasselli experts in their ability to reproduce the German achievements that a new agreement was signed undertaking to supply white zinc chloride at the expiration of the old one. All difficulties were overcome and a chloride was produced that was successful not only in holding the A.T. & S.F. business but in attracting new trade.

In ventures of this type, before a new line of production was undertaken, estimates of probable demand were calculated, price trends were considered, and costs of equipment and production were determined. Guided by these factors new products were added from time to time to the Grasselli line, some filling hitherto unsupplied needs and others representing improved replacements for older products.

Following the triumph of the protective tariff policies in the election of President McKinley, in 1896, Grasselli conducted a survey of the chemical situation to determine which lines of a large number of chemicals previously imported might prove attractive.

The result of their study was that C. A. Grasselli and Thomas McDougall pressed a vigorous appeal at Washington for protective duties on ammonium chloride, hyposulfite of soda, bisulfite of soda, sulfide of soda, chloride of zinc and lithopone. It was found that these materials were being consumed in increasing volume by the iron and steel, photographic, leather, paint, rubber and metal plating industries.

America was largely dependent for supplies for these industrial markets upon European sources, though, as in the case of chloride of zinc, in some instances manufacture had started in the United States. After devoting much time and effort and spending several weeks in Washington during the construction of the tariff bill on the endeavor to obtain protection for American chemicals, Mr. Grasselli learned the night before the bill was to be enacted that their project had failed.

It was after midnight, but he sought out Senator Marcus A. Hanna, of Ohio, with whom he was well acquainted. Explaining the plight of the industry to the Senator, Mr. Grasselli was rewarded with a note from Hanna directed to the chairman in charge of the bill. The committee was in late session that night and Mr. Grasselli succeeded in reach-

ing him, and through Senator Hanna's intervention chemical interests received consideration in the bill. The duties that had been sought were adopted and through them manufacture of the products included in Mr. Grasselli's survey became possible.

This pioneering expanded employment opportunities, the extended line of products proved a satisfactory investment and the production of these new items became an industrial asset to the nation's economy. Mr. Grasselli recorded with satisfaction:

"As in so many other instances on record where customs duties brought into existence industries not hitherto existent in the United States, the articles protected were presently selling in America at prices less than those they had commanded when they were manufactured and sold under free trade."

During this period, a new plant at East Chicago, Indiana, destined to grow like the Grasselli, New Jersey, works into a larger plant than the Cleveland home of Grasselli, experienced its first expansion as a result of booming business under the McKinley Administration. The East Chicago project had been launched early in 1892, and on January 28 that year, Grasselli directors voted to purchase 150 acres at a site in Lake County, Indiana, selected for the company's western plant.

Established that year, the first sulfuric acid was made by the chamber system there in 1893. Three years later nitric acid was being made and in 1897 ten hand units for the manufacture of salt cake and muriatic acid were added. The plant began making Glauber's salts in 1898 and in 1899 C.P. acids and C.P. ammonia were added to the plant's line.

Again during the final decade of the 19th century, advances in the science of chemical manufacture reached the stage where a new process for making sulfuric acid offered competitive advantages over the older methods in use at Grasselli plants. Grasselli officials had been aware that a new development based on zinc smelting was emerging as early as 1880. The company had made an investment in Canadian mines to provide a source of cuprous pyrites at the time it had shifted to this raw material from brimstone, but the mines never proved profitable.

At the time of this shift, the Pennsylvania Salt Company became interested in ores as a source of raw materials and brought to America an English engineer who had built British plants for burning Spanish ores. The raw material was Rio Tinto ore, copper bearing pyrites that were chiefly iron but which contained varying proportions of copper and zinc. Copper and zinc were obtained in such quantity that the processor was able to obtain sufficient metal as a by-product to reduce somewhat the cost of acid.

On a visit by Mr. Grasselli to the Standard plant at Tremley, he stopped to see the Bergenport plant of Pennsylvania Salt and was told that the "salt company was on a metal basis." The remark impressed him, since he recognized that of all methods for making acid that using metal offered the cheapest source and he proposed to introduce the process in Grasselli plants. On another visit in 1882, Mr. Grasselli and Daniel Bailey were entertained at the La Salle, Illinois, plant of the Matthiessen and Hegeler Zinc Works. The plant had been equipped two years earlier to make sulfuric acid as a by-product, a development which Mr. Grasselli noted alarmed western acid makers but only resulted in his tying up his customers to three and five year contracts. On the occasion of their visit they learned from the proprietors of the La Salle plant that they had found it impossible to sell their sulfuric acid. His aside is interesting: "It transpired that their natural market was entirely tied up on contract with Marsh and Harwood and Grasselli."

It was during this visit that the project of making sulfuric acid from zinc was first proposed to him. One evening at Mr. Hegeler's home where he was a guest during his stay, his host suggested that Grasselli should buy out the Peru Zinc Company, of Peru, Illinois; Grasselli, however, was not prepared to undertake this process at that time and the proposal was allowed to drop. Soon, Calvin Wells, president of Peru, visited Grasselli and revealed that he had been observing the success of Matthiessen and Hegeler's experiments in hooking up acid production and zinc roasting.

Wells declared he was convinced the time had come for him to enter the acid production end and that he was about to erect sulfuric acid equipment. He urged Grasselli to undertake the marketing of their acid and Mr. Grasselli agreed. The arrangement was continued for many years with Grasselli acting as sales agents of Peru.

By the end of the 19th century, Mr. Grasselli decided that his firm must enter the zinc industry if Grasselli was to continue making sulfuric acid. He naturally turned to the Peru company which had been suggested to him twenty years earlier as the most advantageous plant available for his purpose. In the negotiations he was told the company represented a capital outlay of approximately \$1,000,000 but that it was earning profits at the potential rating of a capitalization of more than \$3,000,000. This high price determined Mr. Grasselli to break off the negotiations and he returned to his Cleveland plant determined to strive to duplicate Peru's facilities for \$1,000,000 and "make it worth what they claim their property is worth."

It soon became imperative for Grasselli to undertake production of acid from zinc ores and to become, in fact, smelters of zinc. The New Jersey Zinc Company and

other manufacturers were making sulfuric acid, and for its own protection Grasselli must broaden its methods. Late in 1902 the firm decided to enter the zinc business.

They were forced to seek outside their own company the engineering and manufacturing skill to launch this new venture successfully since the metallurgy of zinc was beyond the knowledge of its own personnel. Richard Ziesing and Edward Nesbit, both trained in the Matthiessen and Hegeler works, had built their own plant at Iola, Kansas, but just at the time Grasselli was in search of talent their plant was purchased by Robert Lanyon Company, La Salle, Illinois. They were looking for an opportunity in the chemical industry and joined Grasselli.

Selection of a site for operations next engaged the attention of the directors and E. R. Grasselli and Mr. Ziesing were appointed to find a location for the plant in West Virginia because of the State's enormous resources in coal and natural gas. A site near Clarksburg, West Virginia, was selected, the plant was constructed and a village was built to house employees. Natural gas was piped in and on May 10, 1904, the new unit went into operation.

To direct the new project involving so many new details strange to men of the chemical industry, E. W. Furst, secretary for many years previous of the manufacturing committee and a member also of the supply committee, was selected. As the new venture prospered, the zinc department became established as a separate unit within the company. New furnaces and roasters were added from time to time until the plant reached what was decided to be the limit of its production possibilities for that area, and a new sight for additional expansion was purchased at Meadowbrook, three miles northeast of Clarksburg. Here another zinc smelting plant was constructed and by 1916 it had become the principal smelter of the company, with a capacity of 35,000 tons of metal, bringing the company's total zinc ore capacity in West Virginia to 60,000 tons that year. Again it was deemed advisable to seek another area for further expansion and in 1915, 265 acres of land with underlying coal sufficient to supply the plant for 40 years was acquired at Terre Haute, Indiana, in the heart of that State's rich coal fields. By 1917, less than fifteen years after the company had rather reluctantly entered the spelter field, three Grasselli zinc smelter plants were in full operation.

Meanwhile, during the period of its entrance into and expansion of the new sulfuric acid process, development continued in other lines. Among these was the establishment of a plant in Birmingham, Alabama, in 1901 and the acquisition that year of the Standard Acid Company, of North Tonawanda, New York. The Birmingham plant was constructed at a cost of

\$100,000 to make sulfuric acids and other chemicals including superphosphates under a contract with the Alabama Steel & Wire Company.

The first acid system was brought into production in 1901 and five years later a second system began operating. Other lines manufactured here during the site's operation as a production unit included fertilizers, lime sulfur solution and silicate of soda. Fire destroyed the sulfuric acid plant in 1928 and, in 1932, production was abandoned in all lines and the site became a warehouse of the Grasselli Department of E. I. du Pont de Nemours and Company.

The Standard Acid Company was acquired to enable the company to enter the acetic acid business. Robert McClain, its Canadian proprietor, joined Grasselli when he sold the business and remained with the company until his death. Shortly after the plant was purchased, operations at the site were abandoned and distillation of acetate of lime, a by-product of charcoal manufacture was transferred under Mr. McClain's direction to the company's East Chicago plant.

The company had already started manufacturing silicate of soda when in 1902 the works of the Central Silica Company, at Fortville, Indiana, near Indianapolis, became available. It was purchased from J. L. Mothershead in July that year and the proprietor joined Grasselli taking charge of this new department of the business.

In 1910, Grasselli established at New Castle, Pennsylvania, a plant for the manufacture of sulfuric acid. Operations were expanded in 1915 and in 1926 two systems for ammonia oxidation were added. The company's Canton, Ohio, plant was established in 1911 and the manufacture of sulfuric acid was begun there the same year. Ammonia oxidation operations were started here in September, 1924.

A plant for the manufacture of sulfuric acid in Canada was established also in 1911 and production was started in November. Lime sulfur solution began to be manufactured there in 1911 and continued for ten years until the destruction of the unit by fire after which operations were not resumed. Acetic acid, muriatic acid, Glauber's salts, nitric acid and cadmium anodes were gradually added to the products processed at the Hamilton plant. The plant was transferred to Canadian Industries, Ltd., in 1928, when DuPont acquired Grasselli.

Returning again to the neighborhood of the first Grasselli industrial venture in the United States, the company in 1913 built a \$250,000 sulfuric acid plant at Lockland, Ohio, near Cincinnati. Production of sulfuric acid began in April, at Lockland; muriatic acid and ammonia oxidation processing were added later.

Three years later, in 1916, another sulfuric plant was built at Niles, Ohio, to provide a nearby source for steel works in the Mahoning Valley. Early that year the company decided also to enter the business of manufacturing colors. The site selected adjoined the Grasselli, New Jersey, plant and construction was started in June, 1916. Here an organic chemicals plant was built to make sulfur black and later other colors, including sulfur blue, sulfur brown and sulfur khaki, widely used in World War I for uniforms.

Dyestuffs intermediates were added in 1919 and sulfur colors continued to be made at Grasselli in what was known as the West Works as distinguished from the old East Works of the original plant until the acquisition of the plant by DuPont. At the close of World War I, Grasselli went even more extensively into the manufacture of dyes and in December, 1918, purchased the dyestuffs plant and equipment of the Bayer Company, at Rensselaer, New York. Sterling Products Company had acquired the Bayer property and continuing the manufacture of aspirin, sold to Grasselli the dyestuffs business including the entire plant. In 1924, the Grasselli Dyestuffs Corporation was organized as a subsidiary of the Grasselli Chemical Company. Both the Rensselaer and the Grasselli West Works were transferred to the ownership of the dyestuffs corporation which was headed by G. E. Fisher as president. Subsequently Grasselli became sole United States selling agent for the whole I. G. Farbenindustrie group.

During World War I, Grasselli also entered the explosives field, organizing another subsidiary, the Grasselli Powder Company, and purchasing the American High Explosives Company, the Burton Powder Company and the Cameron Powder Company which operated plants in Pennsylvania. Joseph H. Burton, president of the American and Burton companies, became president of the Grasselli powder subsidiary and after the war the plants manufactured dynamite and black powder for blasting purposes.

Meanwhile, Grasselli was adding several new plants. At Weirton, West Virginia, a plant to make chloride of zinc was acquired in 1925; another was built in Toledo, Ohio, the following year to produce acids for the rapidly growing industrial district and petroleum refineries and, in 1927, a new works at Wurtland, Kentucky, went into the production of acid in the Ashland industrial area.

The progressive expansion of the company was, meanwhile, marked by an accompanying increase in capitalization. In 1913, the capitalization of \$7,500,000 authorized in 1890 was increased to \$20,000,000 by the authorization of 50,000 shares of six percent preferred stock, of \$100 par value per share, and 150,000 shares of common, and

common shareholders received a stock dividend of 37,500 shares. In 1914 there was outstanding \$11,250,000 in common and \$1,500,000 in preferred shares, the authorized preferred stock being issued as the need for funds arose. Stock outstanding as of February 16 during the years listed, increased as follows:

	<u>Common</u>	<u>Preferred</u>
1915	\$11,466,500	\$1,505,300
1916	12,648,200	3,225,100
1917	13,913,000	3,225,100
1918	15,000,000	5,000,000

On January 24, 1918, an additional increase brought the total capitalization of Grasselli on this date to \$50,000,000 of which 150,000 shares were six percent cumulative preferred stock, of \$100 par value, and the balance, or 350,000 shares were common stock of \$100 par value. The following share capital was outstanding in the listed years:

	<u>Common</u>	<u>Preferred</u>
1919	\$16,116,400	\$8,224,200
1920	19,393,452	8,224,200
1921	19,442,800	8,224,200
1922	19,442,800	8,224,200
1923	19,442,800	9,224,200
1924	19,537,300	9,724,200
1925	19,618,800	10,724,200
1926	19,618,800	11,494,200
1927	21,570,480	

Earnings during the closing years of the existence of Grasselli as an independent unit were as follows:

1914	\$1,680,000	
1915	4,859,000	
1916	9,935,000	(before reserves and
1917	4,018,000	depreciation)
1918	4,000,018	
1919	3,972,279	
1920	3,181,441	
1921	2,392,431	
1922	3,743,150	
1923	3,420,754	
1924	3,032,292	
1925	4,154,514	
1926	4,149,030	

Mr. Caesar A. Grasselli resigned as president of the company in 1916 and was succeeded by his son, Thomas S. Grasselli. Eugene A. Grasselli, another son, was treasurer of the company, and under the direction of these two brothers, grandsons of the founder, the business continued until it was acquired by E. I. du Pont de Nemours and Company in 1928. Mr. C. A. Grasselli remained chairman of the Grasselli board until his death.