

**On 21st October 2008, we celebrated 175 years from the birth of Alfred Nobel.**

The small-scale exhibition by the National Board of Patents and Registration of Finland presents the dramatic story of the invention of dynamite and the Stockholm boy's way from poverty to prosperity: to become the richest vagabond in Europe, whose will and legacy made the name Nobel immortal.

## **Dynamite, or Nobel's powder**

**The Nobel family from Stockholm, Sweden, was wealthy and prominent.** The father, Immanuel, was an engineer and successful building contractor; the mother, Andriette (by birth Ahlsell), came from an affluent family. They had two sons. Robert was three and Ludvig only one year old when the family's luck turned. Their home was destroyed by fire. A building being erected by Immanuel's enterprise had to be partly rebuilt because its foundation fell down. Further, a bridge also fell down and some barges carrying building materials were lost at sea. The result was that Immanuel Nobel went bankrupt, which landed the family in poverty.

**In these days of misfortune, Andriette gave birth to a third son.** It was 21st October 1833, and the boy was christened Alfred Bernhard. His start in life did not seem very promising, but today, 175 years later, we know that he was to become a talented scientist, inventor and business genius, and an enormously rich factory owner whose will and legacy made the name Nobel world-famous.

**Besides being an engineer, Immanuel Nobel was also an inventor.** He had a rather poor education, but was extremely enthusiastic about engineering, and continuously worked out both practical and theoretical solutions to various problems. In his work he had acquainted himself with blasting, which was necessary in construction. After his bankruptcy, Immanuel had started to develop explosives for war. At that time, black powder was the only explosive known, and inventions in the field related to how to apply it in practice. Among other things, Immanuel Nobel constructed a land mine and a firing system for it. In vain, he tried to arouse interest in his discoveries among Swedish military authorities.

**When Alfred was five years old, his father moved via Finland to Russia to seek new markets for his products.** Mother Andriette and the boys stayed in Stockholm, and she opened a grocery store by which she provided a modest living for her children. The story goes that the boys, during hardships, contributed by selling matches on the streets of Stockholm.

**Emperor Nicholas I was greatly impressed by Immanuel Nobel's explosives.** In St. Petersburg, Immanuel set up a mechanical workshop which manufactured war material, and the naval mines he designed proved to be his great success. With the help of money from the Emperor, he was able to expand his enterprise. The workshop evolved into a large mechanical engineering company, he expanded the product range, and orders came in. Again, Immanuel Nobel enjoyed success, and his family joined him at a comfortable home in St. Petersburg. The family moved to Russia in the autumn of 1842. At that time, Alfred was nine, and his brothers Robert and Ludvig were already teenagers. Next year, a fourth son was born, named Emil.

**In St. Petersburg, the Nobel brothers received private education at home.** They studied both humanities and natural sciences under top level tutors. They were taught mathematics, physics and chemistry by two professors both of whom were experts in chemistry, which must have influenced Alfred's choice of a career and, perhaps, the contents of his will as well. Besides Swedish, they learned Russian, German, French and English, and were introduced to philosophy and literature. Alfred showed a passion for literature, especially for Shelley and Byron, the English Romantics. He demonstrated literary aptitude, which worried his father.

**The sons were to join their father at his factory.** The name of the factory had been changed to Fondéries et Ateliers Mécaniques Nobel & Fils (Foundry and Mechanical Engineering Factory Nobel & Sons), and the boys were working there in various positions, thus learning about both technology and business. Robert and Ludvig seemed to advance in these areas; Alfred advanced too, but the problem was that he liked to write poetry.

**Immanuel decided that Alfred should stop wasting his time in nonsense.** His son was enthusiastic about chemistry and chemical experiments especially, to that extent that, during the rest of his life, he always had a laboratory – if not elsewhere, then in the kitchen. Alfred had also received theoretical training from the leading experts in the field. The father decided to send Alfred abroad on educational travels, with instructions that he should look around for new product ideas for the family.

**Alfred first travelled to Paris, where he worked with a chemist.** Paris became the city he liked best, and later he was to establish his home there. Now the year was 1850. Professor Théophile-Jules Pelouze, the most prominent chemist and teacher of that time, had set up a private educational laboratory in Paris. One of the professors who tutored the Nobel brothers in natural sciences was Nicholas N. Zinin. He had previously studied under T.J. Pelouze, and thanks to him the young Alfred got an opportunity to study chemistry under the guidance of the brilliant Pelouze.

**At the Pelouze laboratory, Alfred came into contact with Ascanio Sobrero,** who was an Italian chemist, a student of Pelouze and professor at the University of Turin. In 1847, Sobrero had introduced his invention which he initially called pyroglycerine. Later the compound was named nitroglycerine. In his laboratory experiments, Sobrero had mixed nitric and sulfuric acid with glycerine, which is a sweet, oily fluid. Thus he happened to discover a novel explosive, which was far more powerful than gunpowder. Sobrero was dismayed by his creation, and not without reason because his face was badly damaged when a test tube exploded. In his writings he seriously warned his colleagues to stay away from that dangerous substance, whose peculiar properties made it uncontrollable. He was of the opinion that nitroglycerine would never be of any practical use.

**After a year in Paris, Alfred, having learned both languages and sciences, set out to see the world.** He visited Italy, Germany and the United States, studying the latest technological advances. Later on, travelling became his way of living while managing his numerous factories and businesses in different countries. His friend in Paris, Victor Hugo, the author, called him "the richest vagabond in Europe".

**Russia was arming in preparation for the Crimean War,** which broke out in 1853 between Russia and the Ottoman Empire in an alliance with the United Kingdom and France. Nobel & Sons was manufacturing Immanuel's famous naval mines and other war material at an accelerating pace, and Alfred returned home to work at the company. Meanwhile, Immanuel and his elder sons had placed mines in the surroundings of the fortifications of Sveaborg and Kronstadt in the Gulf of Finland, and in the approaches to the bottom of the Gulf. The result was that, even though the English had a considerable naval force, they could neither occupy these fortifications nor reach St. Petersburg. In 1853, Immanuel Nobel was presented at court and awarded the Imperial Gold Medal, both rare distinctions for a foreigner.

**Then, Emperor Nicholas I died, Alexander II came to the throne, and the Crimean War ended.** The demand for war material died away, and Nobel & Sons got into dire straits. In 1856, the factory employed more than 1,000 people and had full stocks of manufacturing material, but no orders came in. Once more, Immanuel Nobel was forced into bankruptcy. He gave up and left for Sweden with his wife and the 13-years-old Emil. The business problems in St. Petersburg he left to be solved by his elder sons.

**Alfred was occupied by nitroglycerine.** Compared with gunpowder, it possessed huge explosive power. It would be a success in mining and construction, which Alfred believed were expanding industries. While the elder brothers struggled to solve the problems in running the family business, Alfred engaged in manufacturing nitroglycerine for his experiments, aiming to find a solution for taming that unstable substance. He explained his experiments in letters to his father Immanuel in Stockholm, and Immanuel, who used to recover from losses quite quickly, also devoted himself to experimenting with nitroglycerine. However, he did not aim at using the material in construction, but in his beloved mines.

**Nitroglycerine is a highly explosive fluid; however, it is not easy to detonate.** Indeed, you can burn it in fire, and it does not explode. On the other hand, the nitration process, in which nitric acid is added to nitroglycerine, generates so much heat that the substance may explode as a result. A powerful impact makes it explode, but usually only in that impacted spot; however, the heat produced by the impact may expand the explosion. This viscous fluid may also explode randomly, without any clear reason.

**Alfred Nobel conducted experiments in St. Petersburg.** He improved the nitration process and learned to control the manufacture of nitroglycerine, but the challenge was how to make it explode in a controlled manner. The answer was black powder, which, mixed with nitroglycerine, exploded when set on fire and spread the explosion throughout the viscous fluid. Assisted by his brother Robert, he tested this discovery on the ice of the river Neva outside the city. When he found out how to mix gunpowder and nitroglycerine in the right proportion, and there was demand for the product, brother Ludvig, who was a businessman, also got interested in it.

**Immanuel Nobel had set up a laboratory in Heleneborg, Stockholm.** He devoted his time to mixing nitroglycerine and gunpowder, and even thought that he himself had developed the process. This led to close correspondence between father and son, until Immanuel realised that, compared with Alfred, he was just an amateur at chemistry.

**In 1863, Alfred moved to Stockholm.** He started working at the Heleneborg laboratory, which was extended at that time due to increased demand for nitroglycerine. In October 1863, he was granted a Swedish patent on an explosive. This was his first official patent. At that time he was thirty years old. When Alfred Nobel died 33 years later, he had been granted 355 patents on various inventions all over the world.

**The youngest brother, Emil, was assisting Alfred at the Heleneborg laboratory.** He was only twenty, but already had some experience in chemistry, which he showed a particular interest in. The two brothers succeeded in improving the process for manufacturing nitroglycerine so that mass production could be started up. In the spring of 1864, Alfred came up with a significant invention: the detonator, which made nitroglycerine explode due to a powerful detonating impulse. On these "improvements in manufacturing and using nitroglycerine", he obtained a patent in Sweden in the summer of 1864, and in the autumn Robert Nobel, settled in Helsinki and acting as Alfred's agent, filed a corresponding patent privilege application with the Imperial Senate of Finland.

**Come autumn, Emil Nobel was no more.** On 3rd September 1864, a huge explosion shook the city of Stockholm. Emil Nobel and a young engineer newly employed in the enterprise had been in the laboratory making nitroglycerine, when the terrifying nature of this compound got out of control. Because of the temperature increase in the nitration process, you must focus special attention on cooling. Apparently, a greater volume of nitroglycerine had heated up over the critical limit of 180 degrees Celcius. The explosive oil showed its power, killing five people and destroying the laboratory.

**Immanuel Nobel was discouraged.** A month after this traumatic accident, he was paralysed, but his son Alfred did not give up. The manufacture and use of nitroglycerine were forbidden in the area of Stockholm. On the other hand, this event had brought the explosive to public notice. Although it was dangerous, it was less hazardous than gunpowder, and it had many times the power. In mining and tunnel construction, especially, it had an advantage that it did not smoke.

**Alfred Nobel established a floating laboratory and factory on a barge,** which was towed from one place to another on Lake Mälaren. The Nobels continued to produce nitroglycerine; it was sold under the name "Blasting Oil", and there was a brisk demand for it. In the same autumn, a company named *Nitroglycerin Aktiebolaget* was established in Stockholm. Besides Alfred and Immanuel Nobel, the owners included two businessmen from Stockholm. Alfred Nobel had now founded his first company, and his progress towards a great career in business had begun.

**In the spring of 1865, the company could continue to operate back on terra firma.** The place was *Vinterviken*, by a bay sheltered by hills near Stockholm by Lake Mälaren. The factory was first run in simple sheds and partly outdoors, which was practical because every now and then explosions would go off, and you often needed to repair and rebuild the buildings. Thanks to Alfred Nobel's blasting cap inventions, you could detonate nitroglycerine quite safely, but the manufacture, storage and especially transport of that undisciplined fluid was still dangerous.

**As well as in Sweden, Alfred Nobel had established a blasting oil factory in Norway and in Germany in 1865.** Next year it was the turn of the United States, where Nobel travelled not only to defend his threatened patent rights but also to start up business ventures. Simultaneously with the start-up of the United States Blasting Oil Company, a disastrous explosion took place at the factory in Krümmel, Germany, which once again aroused fear and opposition against the Nobel products. Something had to be done; Alfred had to bring this capricious substance under control. Solid form would be a solution. Nobel now engaged in systematic research. A tiny organism with a silicon shell came to his rescue.

**The German factory was located in Krümmel, sheltered by hills and sand dunes by the river Elbe.** The spot resembled *Vinterviken* in Sweden. In the previous year, Alfred Nobel had settled there, and now he was constructing a laboratory on a raft anchored on the river. There he started experiments to tackle the problems with the explosive. He let different porous materials such as paper, waste wood, brick dust, coal, dry clay, gypsum bars and clay bars absorb nitroglycerine. All of these are mentioned in the patent application which he filed in Finland in 1867, but, first of all, the application discloses kieselguhr, a diatomaceous earth.

**This is soil formed by the sedimentation of siliciferous shells of unicellular algae.** The dunes around the Krümmel factory were of pure, powder-like kieselguhr. Soon Alfred Nobel found out that this powdery material saturated with oily nitroglycerine constituted a firm and obedient paste that was easy to mould. Indeed, this pretty powder calmed down the wild, volatile fluid.

**In his patent application, Alfred Nobel describes the explosive paste as follows:** "The invention possesses an explosive power greatest in use today. Its advantage is that it is so little dangerous that it will never accidentally cause any damage, and its force is as if hidden, only to be used when necessary and wanted." In his application, he calls the substance "Dynamite, or Nobel's powder". Nobel was granted a Swedish patent in 1867, which was followed by a patent in Finland early next year.

**Nobel shaped the explosive paste called dynamite into rods.** The form has its advantages in terms of handling, storage and transport, and it can be inserted into holes drilled in rock. Blasting oil was stored in bottles, from which it was poured into the hole. Instead, you could now use a rod of proper size, and, with certainty, it would not explode until you ignited it with a fuse and detonator. You could also use the paste in clefts in a rock, which was impossible using nitroglycerine alone.

**Those were times when technology progressed by leaps and bounds.** Trade and traffic began to thrive all over the world. Roads and railways, tunnels, bridges, ports, mines and factories were constructed. For quarrying, pneumatic drills with diamond crowns came into general use. It was necessary that explosives were reliable in use, and the reliability contributed to enhanced capacity in construction and mining industries. The demand for dynamite increased exponentially.

**In 1868, Alfred and Immanuel Nobel were awarded the Letterstedt Prize by the Royal Swedish Academy of Sciences.** Both Nobels highly valued this award. Jacob Letterstedt, born Lallerstedt, was a son to a Swedish farmer. When young, he left his home country and travelled via England to Cape Town. He started from scratch and made a huge fortune; he was appointed Consul of Sweden-Norway and a member of the Royal Swedish Academy of Sciences. Just before his death in 1862, he drew up a will, which stipulated an extensive bequest to the Royal Swedish Academy of Sciences. The interest was to be expended for annual awards for eminence in science, literature or art, or for a significant discovery with practical importance to humanity.

**Alfred Nobel, who had many irons in the fire, needed assistance in taking care of this numerous businesses.** One of his assistants was Countess Bertha Kinsky, who arrived from Vienna to Paris in 1876 in order to work as his secretary and housekeeper. However, she did not stay very long in Paris, but returned to Vienna to marry Baron von Suttner from Italy. Bertha and Alfred, however, remained lifelong friends. They carried on correspondence, and Nobel closely monitored the international peace movement, as Bertha von Suttner emerged as one of its leaders in the late 1800s.

**On 10th December 1896, Alfred Nobel died at the age of 63 in San Remo, Italy.** During his life, he had established nearly 90 enterprises in more than 20 countries: for example, the first holding company in the world, the Nobel Dynamite Trust Company. His patented inventions laid a foundation for his businesses, by which he had amassed one of the most considerable fortunes in the world. Further, his partnership in the elder brothers' flourishing oil empire in the Caucasus had added to his wealth.

**In November 1895, Alfred Nobel had drawn up a will at the Swedish-Norwegian Club in Paris. (...)**

"The whole of my remaining realisable estate shall be dealt with in the following way: The capital shall be invested by my executors in safe securities and shall constitute a fund, the interest on which shall be annually distributed in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit on mankind. The said interest shall be divided into five equal parts, which shall be apportioned as follows: one part to the person who shall have made the most important discovery or invention within the field of physics; one part to the person who shall have made the most important chemical discovery or improvement; one part to the person who shall have made the most important discovery within the domain of physiology or medicine; one part to the person who shall have produced in the field of literature the most outstanding work of an idealistic tendency; and one part to the person who shall have done the most or the best work for fraternity among nations, for the abolition or reduction of standing armies and for the holding and promotion of peace congresses. (...) It is my express wish that in awarding the prizes no consideration whatever shall be given to the nationality of the candidates, but that the most worthy shall receive the prize, whether he be a Scandinavian or not."

The original text in Finnish is written by Kastehelmi Nikkanen, Exhibition Assistant with the National Board of Patents and Registration of Finland, and it is based on the Nobel Foundation's website [www.nobelprize.org](http://www.nobelprize.org) and on Finnish patents 77 (1864) and 95 (1868).

Historical pictures in the exhibition © Nobel Foundation

The exhibition will be open until 23 October 2009, Mon - Fri from 8 a.m. to 4.15 p.m.  
at the NBPR Client Service, Arkadiankatu 6 A, Helsinki.

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