

NOBEL PRIZE MUSEUM

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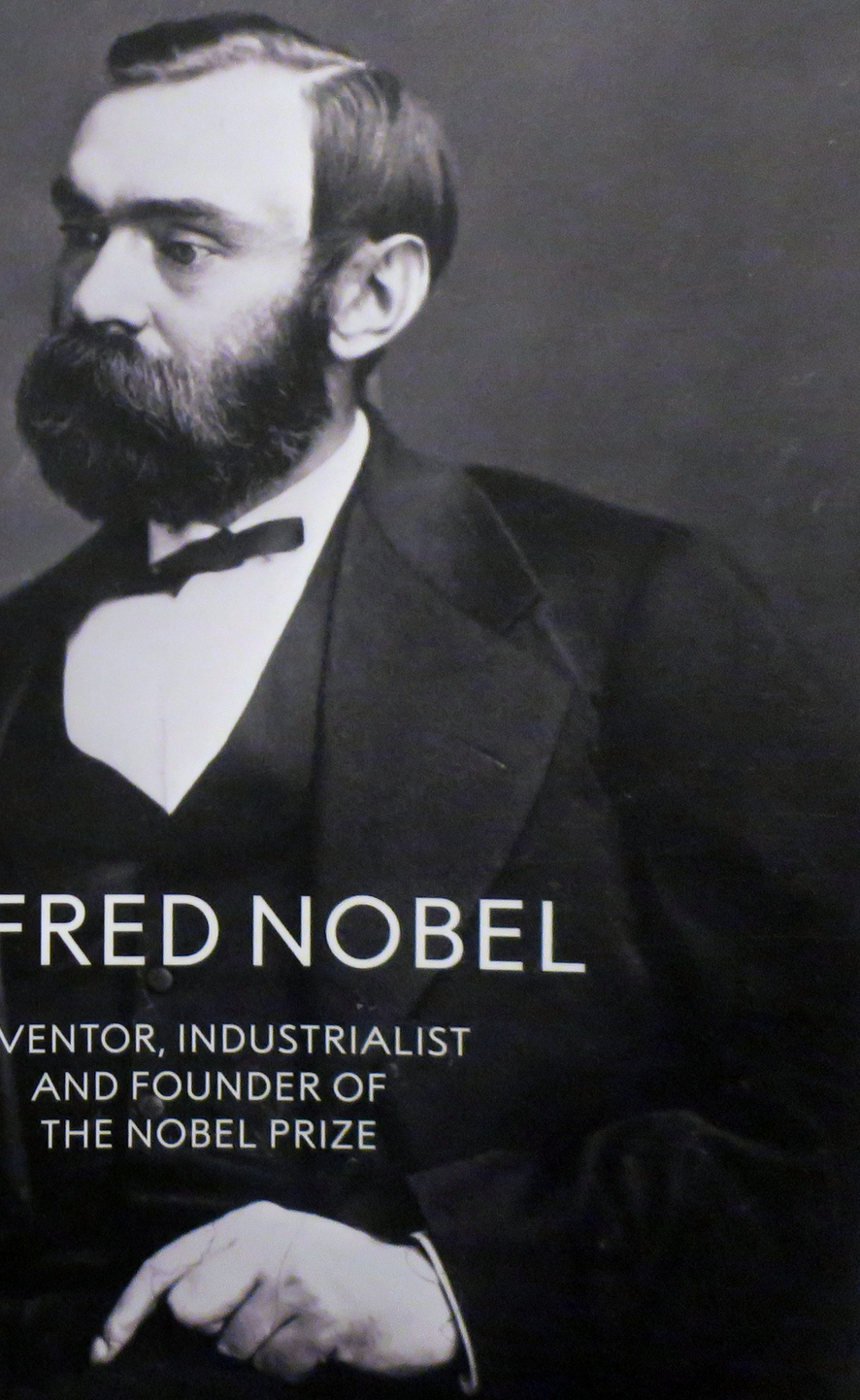
THE NOBEL PRIZE



ALFRED NOBEL

INVENTOR, INDUSTRIALIST AND FOUNDER OF THE NOBEL PRIZE

English

Alfred Nobel

INVENTOR, INDUSTRIALIST AND FOUNDER OF THE NOBEL PRIZE



Immanuel Nobel surrounded by his sons and colleagues in Saint Petersburg. Alfred Nobel is in the front row on the far right.

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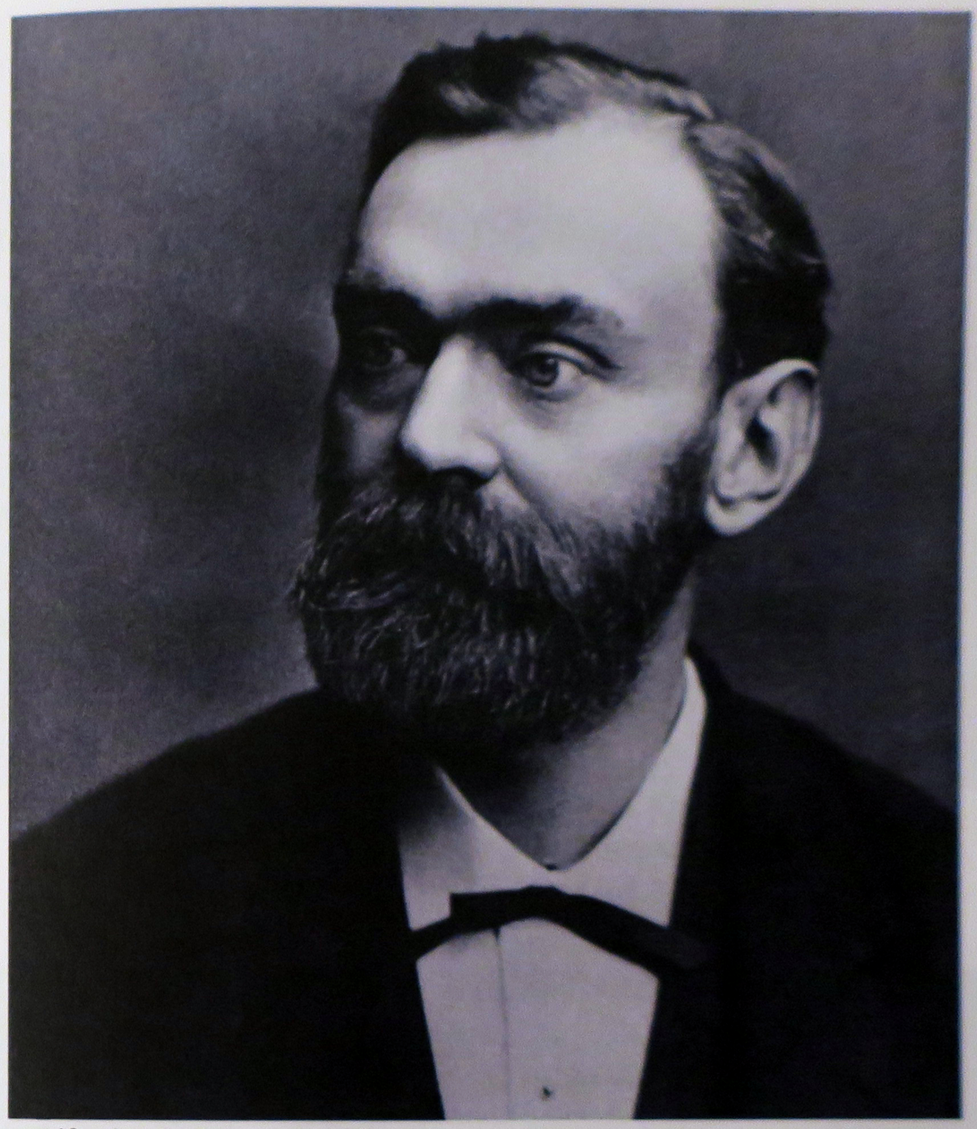
Introduction

Alfred Nobel lived during the 19th century's revolutionary developments in science, culture and society. He experienced the reshaping of his world by technology, war, economic shifts and political transformations. Nobel played a role in these changes.

Nobel's inventions and the ways in which they were used were crucial to industrialization. His new explosives allowed the mining industry to increase production and to supply raw materials to expanding industries. They played key roles in the expansion of modern communications, as countries around the world began building railroads, roads, tunnels and bridges. They also found important military uses and Nobel made significant improvements to weapons and ammunitions technologies.

Alfred Nobel lived and visited many different places over the years. He grew up in relatively simple circumstances in 1830's Stockholm. He spent his youth in St. Petersburg, Russia, after his father had established himself as an inventor there. From St. Petersburg, he set off on study trips to Europe and North America. When his parents returned to Stockholm, Nobel joined them to work with his father in developing new explosives. In the 1860s, his efforts to commercialize his inventions took him on lengthy business trips and visits to factories in many locations, including Krümmel outside Hamburg, Germany, where he took up residence in 1865. In 1873, Nobel moved to Paris to live in what was perhaps the most vibrant metropolis of the day. There, he continued his work as an inventor and his wealth grew, but he also struggled with risky business ventures and legal disputes. Toward the end of his life, he settled in San Remo, Italy, where he died in 1896.



Alfred Nobel around 1880.

During his life, Nobel was famous as the inventor of dynamite. He likely would have been remembered for his inventions even today. But the main reason for his fame is his will, which laid the foundation for Alfred Nobel's most famous contribution to posterity – the Nobel Prize.

Childhood and Youth

The Nobel family can be traced quite far back in time. An early ancestor, Olof Rudbeck, is one of the most remarkable figures in the history of Swedish science. Alfred Nobel's father, Immanuel Nobel, studied architecture and worked on various construction projects, but his work covered a broad range of technical fields. In 1827, he married Andriette Ahlsell in Stockholm. She was the daughter of an accountant who came from a family of farmers. Their first son, Robert, was born in 1829, followed two years later by another son, Ludvig. On October 21, 1833, Alfred was born.

Immanuel Nobel's financial position fluctuated back and forth between great success and the brink of ruin. In 1837, the father set off for Turku, Finland, which at the time was under Russian rule. From there he later travelled to Russia to present his technical inventions. After Immanuel Nobel successfully developed and industrialized the production of naval mines in Saint Petersburg, the family reunited there in 1842. A year later the Nobels had another son, Emil.

Alfred Nobel and his brothers received private instruction, including from Nicolai Zinin, one of Russia's foremost chemists. Young Alfred also developed budding interests beyond technology and industry, including languages and literature. At the age of seventeen, he set off on a trip through Europe. In Paris, he met one of the great chemists of the day – Théophile Jules Pelouze. After his visit in Paris, Alfred traveled to the United States.

In 1853 the Crimean War broke out. During the war, the Nobel family's business was almost entirely dependent on large orders from the Russian military. After the war, the orders stopped coming and the Nobel family once again fell into financial troubles. Around 1859, Immanuel and Andri-



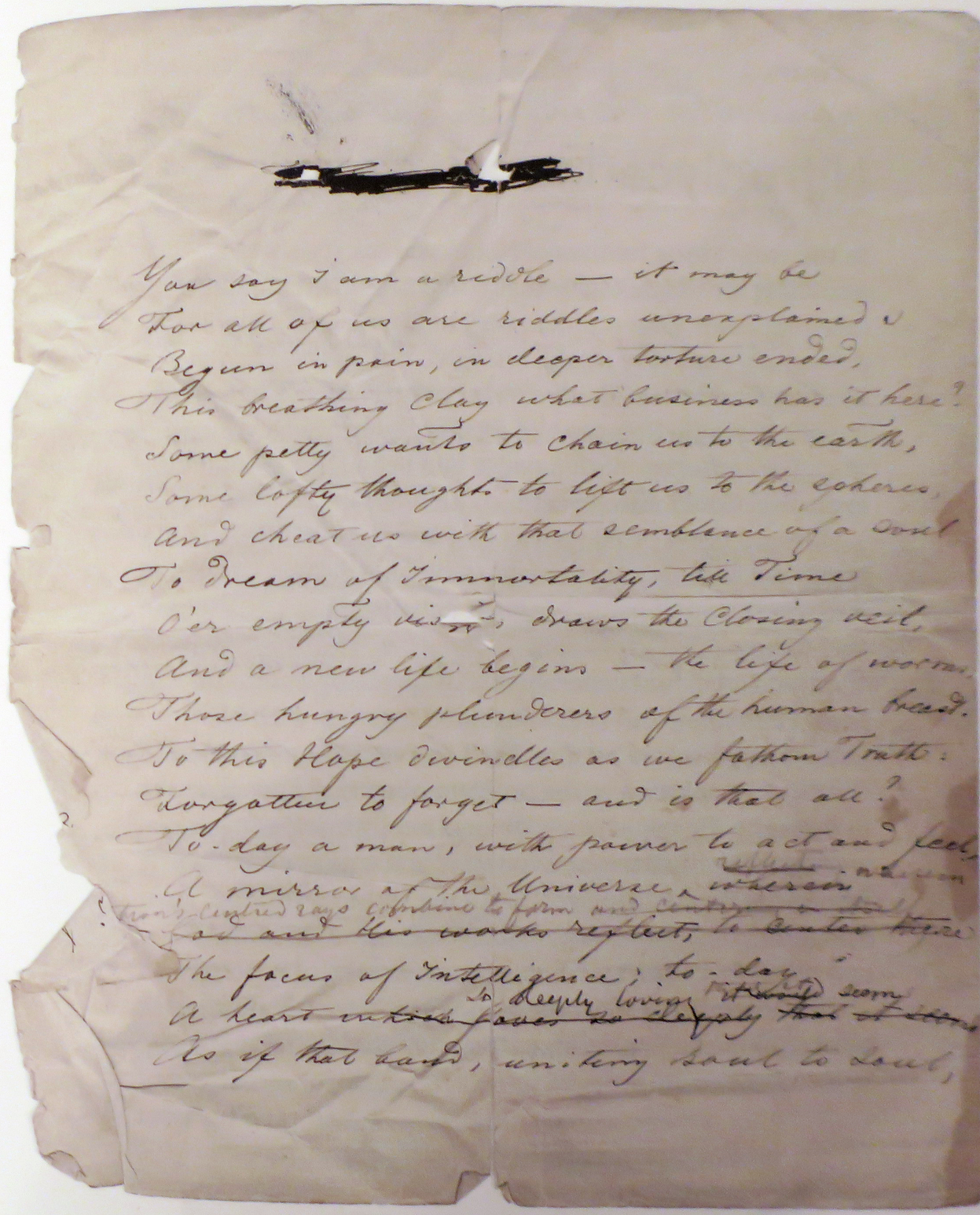
Following his return to Sweden around 1860, Immanuel Nobel made a number of watercolor drawings and sketches showing his mines.





Alfred Nobel in his twenties.

ette Nobel returned to Stockholm with their youngest son, Emil, while the older brothers remained behind. Alfred used St. Petersburg as his home base for several years. Having worked with his father on a number of technical projects, he continued these but also began devoting more energy to his own inventions.



You say I am a riddle — it may be
For all of us are riddles unexplained &
Begun in pain, in deeper torture ended,
This breathing Clay what business has it here?
Some petty wants to chain us to the earth,
Some lofty thoughts to lift us to the spheres,
And cheat us with that semblance of a soul
To dream of Immortality, till Time
O'er empty visions, draws the Closing veil,
And a new life begins — the life of worms,
Those hungry plunderers of the human breast.
To this Hope dwindles as we fathom Truth:
Forgotten to forget — and is that all?
To-day a man, with power to act and feel,
A mirror of the Universe, ~~wherein~~ reflect
tion's centred rays combine to form and ~~centre~~
~~God and His works reflect, to center there~~
The focus of Intelligence; to-day
A heart ~~which~~ so deeply loving it ~~would~~ seem ~~loves so deeply that it seems~~
As if that band, uniting soul to soul,

In his youth Alfred Nobel wrote poems, including "You say I am a riddle." His choice to write in English may have been motivated by admiration for such English poets as Shelley and Byron.

Nitroglycerin

In the early 1860s Immanuel Nobel and his sons were searching for technologies that could provide them with new successes. One problem they began studying involved a powerfully explosive liquid, nitroglycerin, which Nicolai Zinin had told them about several years earlier. The Italian chemist Ascanio Sobrero had discovered nitroglycerine in 1847. For centuries black powder had been the dominant explosive. Could nitroglycerin be an alternative?

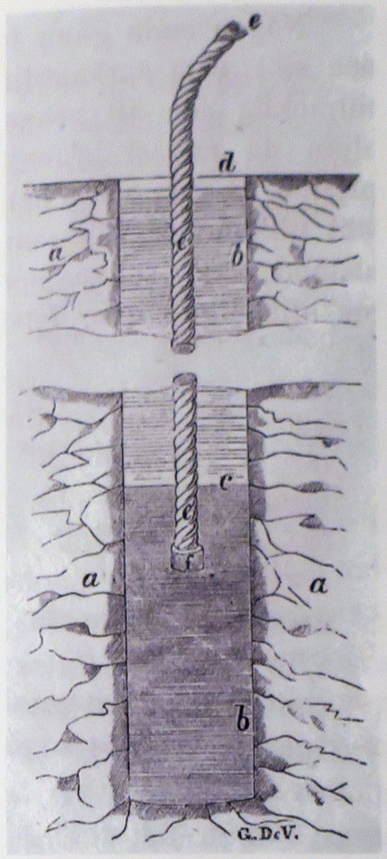
Nitroglycerin's problem was that it was difficult to handle. It was not entirely easy to make it explode when you wanted it to. On the other hand, heat or mechanical impact could lead to unwanted explosions.

Alfred Nobel first experimented with nitroglycerin in Saint Petersburg and later continued together with his father and youngest brother, Emil, in Stockholm. He soon developed a solution to the problem of getting nitroglycerin to detonate. He could cause detonation by immersing a wooden tube filled with gunpowder and equipped with a fuse in the liquid nitroglycerin. In the summer of 1864, Nobel received a patent for his invention in Sweden and several other countries.

On September 3, 1864, the Nobel family was dealt a terrible blow. An explosion occurred in their laboratory, and



An early kind of detonator: a wooden tube filled with gunpowder and equipped with a fuse.



The final version of the detonator from 1865 employed a detonator cap of metal containing a charge of mercury fulminate.

Emil Nobel and 4 others working in and around the laboratory were killed instantly. Alfred Nobel was nearby, but avoided serious injuries. Several months later, Immanuel Nobel suffered a stroke. He was a broken man and never truly recovered.

Alfred Nobel continued his work on nitroglycerin without hesitation. This detonator was and, in a way, remained Alfred Nobel's most revolutionary invention. It made the continued development of new explosives possible. Thanks to his detonator, nitroglycerin or blasting oil, as Nobel referred to it, had become a practical explosive.

From Experiment to Industry

When Alfred and Immanuel Nobel sought to convert their experiments with nitroglycerin into a business, they had to look beyond just technical developments. Much of Alfred Nobel's time was devoted to finances and running the business.

Setting up the manufacturing processes required capital. Raw materials were expensive, as were equipment and factories. It was vital to find people who believed in the idea and who were willing to invest in it. The most important backer for establishing the Nobels' company in Sweden was the businessman J.W. Smitt, who played an important role in Nitroglycerin Aktie Bolaget (translation: Nitroglycerin Incorporated). The company was founded in Stockholm in October 1864 and a factory was built at Vinterviken outside Stockholm.

Initially Nobel served as director of the new company, but soon turned his attention to other countries where his inventions could be marketed. From the very start, Nobel regarded the entire world as a market for his blasting oil. How could he distribute it worldwide? Nobel likely realized immediately that it would be impossible to manufacture blasting oil in Stockholm and export it worldwide from there. Transporting nitroglycerin was risky. For this and other reasons, various countries had imposed regulations on the new explosive, which made export problematic. Nobel decided to establish separate companies and factories in several countries.

When looking for potential customers for his new explosives and for investors, Nobel focused on industries that might have the most use for blasting oil: railway construction and mining.



The factory at Vinterviken outside Stockholm in the 1870s.

In an early effort in Norway, which at that time was in a political union with Sweden, Nobel's colleagues found investors and in June 1865 established a Norwegian explosive company. Nobel sold the Norwegian rights to his patent without taking part ownership of the Norwegian company. He probably did so to obtain financing for expansion in other countries.

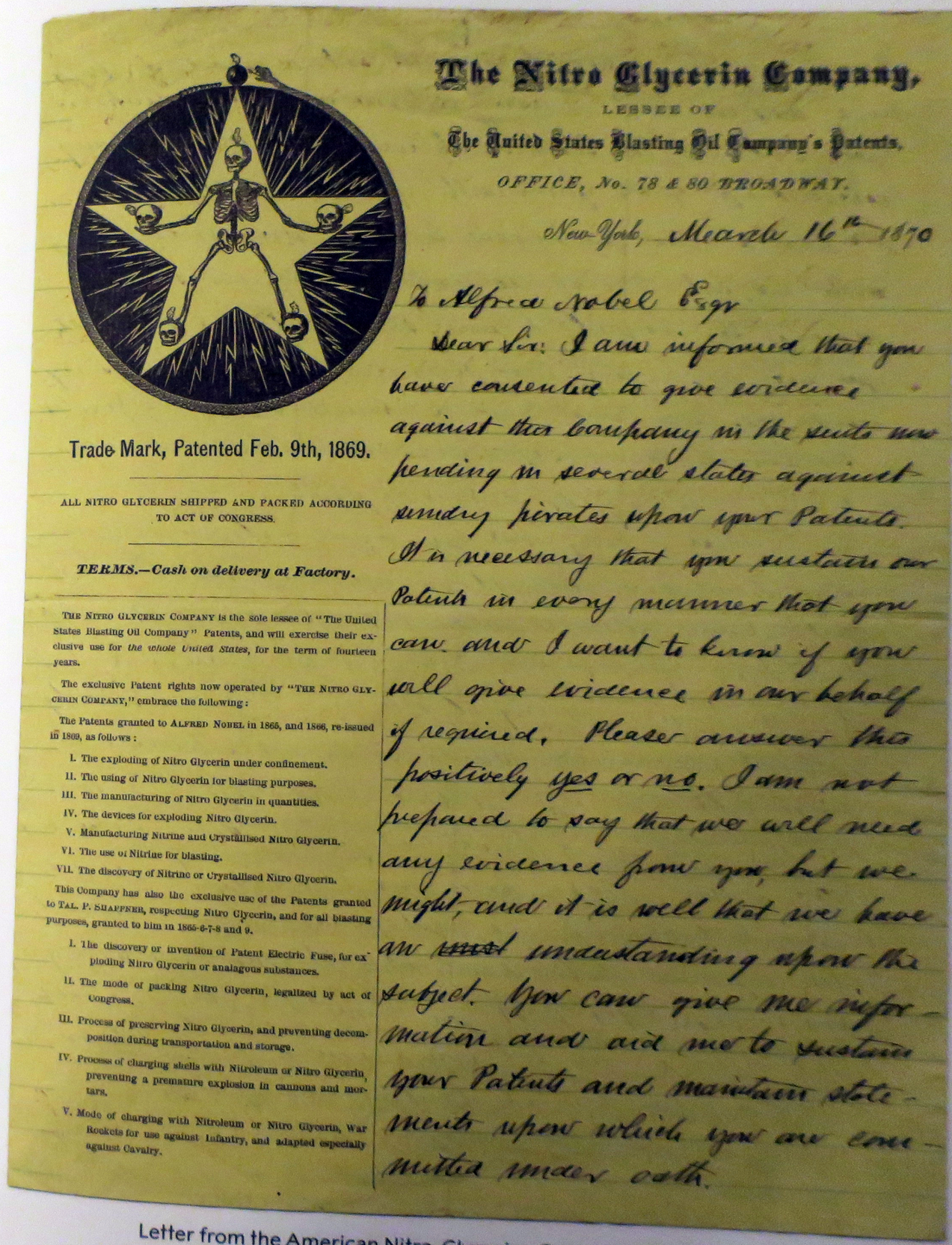
It likely seemed natural to set up companies in Finland and Russia, where members of his family still lived. Robert Nobel lived in Helsinki, and in 1865 he built a factory just outside of Fredriksberg. There was, however, almost no Finnish mining industry and no strong push to build roads or railways. When it was rumored that the Russian Czar was considering a ban on all explosives manufacturing in Finland, Robert Nobel abandoned the effort.

Alfred Nobel's first attempt to market his blasting oil outside Scandinavia focused on Hamburg, Germany. Strategically, his choice of location was smart. Hamburg had growing industries, a large harbor and a mining district not far away. Nobel also had personal contacts who offered an opening to the German market. Theodor and Wilhelm Winkler, two brothers who operated a quarry in the Stockholm archipelago, were the sons of a German merchant from Hamburg who had settled in Stockholm.

In late March 1865, Nobel traveled to Hamburg to introduce blasting oil to the German market. Just a few days after his arrival, he was able to begin manufacturing under provisory circumstances. The firm Alfred Nobel & Co. was formed in 1865. The business grew and Nobel remained in Hamburg. A factory was eventually built in Krümmel, outside Hamburg.

The United States had a huge market for explosives. As early as 1864, Nobel's experiments with nitroglycerin had attracted the interest of an American, Taliaferro Preston Shaffner, who visited Stockholm to negotiate with Nobel to market blasting oil in the US, but no deal was made. After returning to the United States, Shaffner experimented with nitroglycerin on his own. A long legal battle started between Nobel and Shaffner when Nobel applied for an American patent for his blasting oil and detonator. Nobel also had other contacts in the US, and in the spring of 1866 he traveled there to settle the disputes and setup operations. He was involved in establishing several American companies, but he only had limited success in the US.

Nobel's American companies expanded, but faced other competitors on the US market. Competition from black powder manufacturers remained, and there was new competition from producers of explosives similar to blasting oil and dynamite. This huge and wild market made it impossible to identify every case of patent infringement and to take pirating manufacturers to court.



The Nitro Glycerin Company,

LESSEE OF

The United States Blasting Oil Company's Patents.

OFFICE, No. 78 & 80 BROADWAY.

New York, March 16th 1870

To Alfred Nobel Esqr

Dear Sir: I am informed that you have consented to give evidence against this Company in the suits now pending in several states against sundry pirates upon your Patents. It is necessary that you sustain our Patents in every manner that you can and I want to know if you will give evidence in our behalf if required. Please answer this positively yes or no. I am not prepared to say that we will need any evidence from you, but we might, and it is well that we have an ~~exact~~ understanding upon the subject. You can give me information and aid me to sustain your Patents and maintain statements upon which you are committed under oath.

Trade Mark, Patented Feb. 9th, 1869.

ALL NITRO GLYCERIN SHIPPED AND PACKED ACCORDING TO ACT OF CONGRESS.

TERMS.—Cash on delivery at Factory.

THE NITRO GLYCERIN COMPANY is the sole lessee of "The United States Blasting Oil Company" Patents, and will exercise their exclusive use for *the whole United States*, for the term of fourteen years.

The exclusive Patent rights now operated by "THE NITRO GLYCERIN COMPANY," embrace the following:

The Patents granted to ALFRED NOBEL in 1865, and 1866, re-issued in 1869, as follows:

I. The exploding of Nitro Glycerin under confinement.
II. The using of Nitro Glycerin for blasting purposes.
III. The manufacturing of Nitro Glycerin in quantities.
IV. The devices for exploding Nitro Glycerin.
V. Manufacturing Nitrine and Crystallised Nitro Glycerin.
VI. The use of Nitrine for blasting.
VII. The discovery of Nitrine or Crystallised Nitro Glycerin.

This Company has also the exclusive use of the Patents granted to TAL. P. SHAFFNER, respecting Nitro Glycerin, and for all blasting purposes, granted to him in 1865-6-7-8 and 9.

I. The discovery or invention of Patent Electric Fuse, for exploding Nitro Glycerin or analagous substances.
II. The mode of packing Nitro Glycerin, legalized by act of Congress.
III. Process of preserving Nitro Glycerin, and preventing decomposition during transportation and storage.
IV. Process of charging shells with Nitroleum or Nitro Glycerin, preventing a premature explosion in cannons and mortars.
V. Mode of charging with Nitroleum or Nitro Glycerin, War Rockets for use against Infantry, and adapted especially against Cavalry.

Letter from the American Nitro-Glycerine Company.

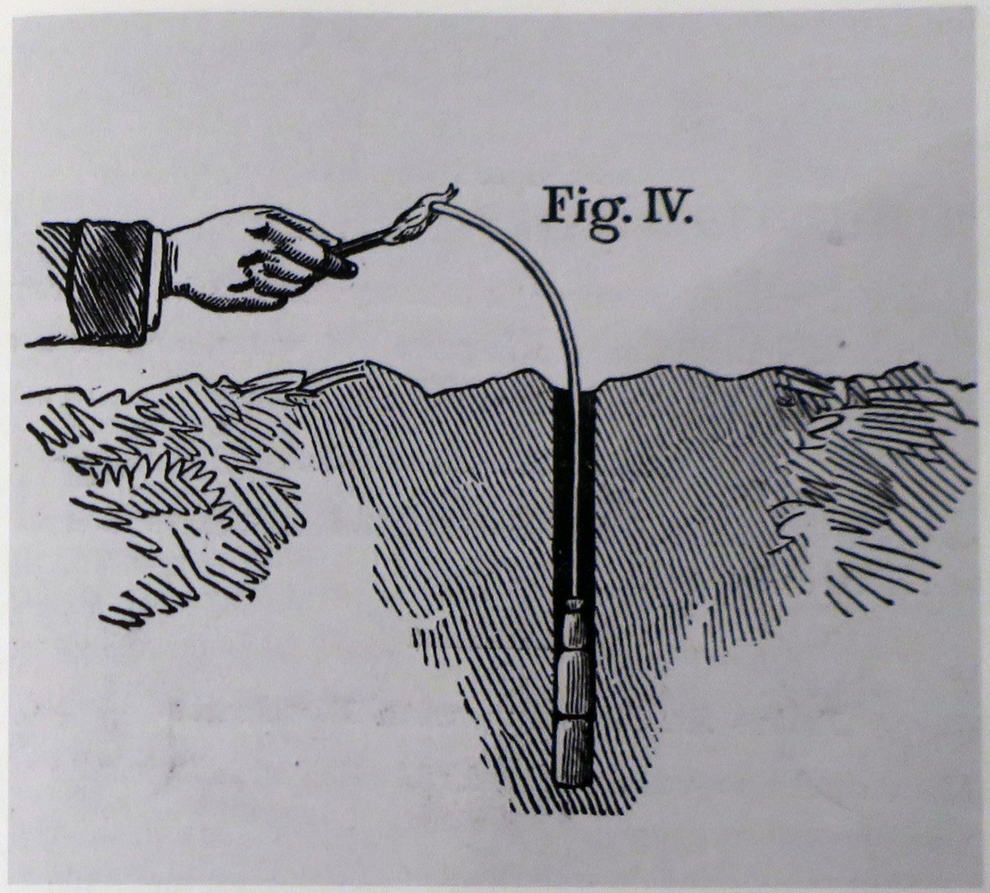
Dynamite

It soon became clear that pure nitroglycerin was not an ideal explosive. Several accidental explosions, both during production and out in the field, created doubts about its safety.

In the spring of 1866, while Nobel was visiting New York, a series of tragic accidents occurred at different places around the world. With over 200 killed in these explosions, Nobel must have been deeply troubled. Obviously, the accidents also caused significant problems for his business. Nobel had previously considered whether adding other materials might make blasting oil safer to use, and he now began re-examining the problem.

Upon his return to Krümmel, he experimented with different mixes and additives. He finally settled upon a type of porous sand known as kieselguhr, which was available in large quantities from sand dunes near Krümmel. Kieselguhr is filled with pores created by fossilized diatoms. These pores allow the material to absorb water. Nobel found that if the kieselguhr was first dried in a kiln, it could absorb up to four times its own volume in liquid nitroglycerin. The result was a dough-like material that could be shaped into sticks. These sticks could be made to explode using a detonator cap. The sticks were unaffected by rough handling and, if lit on fire, they burned slowly and gently, without exploding. In late 1866 and early 1867, Nobel applied for a patent for this new explosive in several countries. He called it "dynamite."

Dynamite had somewhat less explosive power than blasting oil, but it was more powerful than black powder.



Igniting a dynamite cartridge.

Fewer and smaller holes were needed for charges compared with black powder, which meant lower labor costs. In mining, the advantages of dynamite quickly became apparent since it created less smoke than black powder.

Industrial Expansion

Dynamite greatly reduced transport risks. Alfred Nobel's German business partner Eduard Bandmann argued that the company should expand the Krümmel factory and let it supply dynamite for most of the European market, but Nobel continued establishing companies and factories in each country. The German company established factories in Zamky near Prague and in Bratislava, which at the time was called Pressburg and belonged to Hungary. The company also bought a dynamite factory in Schlebusch.

Nobel also continued the expansion in other countries. The United Kingdom was an attractive market with extensive railways and large coal mining districts. Sales in the UK could also open the door to the British colonies, including India and its huge railway construction projects. Orlando Webb, a business lawyer, became the English import agent for blasting oil from the factory at Krümmel and was an important early contact for Nobel. Nobel often traveled to the UK carrying a suitcase full of dynamite from the factory at Krümmel. Nobel also tried setting up production in Scotland, where he worked with John Downie, the Scottish import agent for the factory at Krümmel.

Progress in the UK was slow, though, because of strict restrictions on the manufacture and import of nitroglycerin-based explosives. Sir Frederick Abel, the Chief Chemist to the War Office, was an influential person and important British authority in the field. Abel also had a certain level of personal interest in the matter, because he had discovered a safer method for the production of gun cotton. He clearly did not want dynamite to compete with his invention. Only after several years was Nobel successful in obtaining permission for dynamite manufacturing.



Alfred Nobel, at the right, and his colleague Alarik Liedbeck in the doorway of Nobel's house in Lauriston, near Ardeer.

In 1871, the British Dynamite Company was formed in Glasgow. A factory was opened outside Ardeer, where some development work for the explosives was carried out. Nobel visited often and even bought a house in the nearby village of Lauriston so he could spend longer periods at the factory.

France had less mining and railway construction than the UK and Germany and less demand for explosives. The French state also held a monopoly on black powder manufacturing, so prices for black powder were high. If dynamite production could be established in France, the potential profits were great. The main question was whether nitro-



"Nitroglycerin Hill" at the factory at Ardeer around 1880.

glycerin-based explosives would be included in the state monopoly.

In 1867, while attempting to setup production in France, Paul-François Barbe contacted Nobel. This was the start of a long business relationship. After the outbreak of the Franco-Prussian War, France needed to begin production of dynamite as soon as possible. A factory was opened in Paulilles, at the foot of the Pyrenees Mountains, and in March 1871 deliveries began, though they were soon halted because of debate about the state gunpowder monopoly. In 1875, the production and sales of dynamite were finally

opened to commercial operations and Nobel and Barbe resumed their operations.

In the mean time, Barbe was working to introduce dynamite on other markets outside France, including Italy. After some disagreements with Nobel's German business partners, Nobel invited them to become part owners in the company that he and Barbe were planning. The new company, *Società Anonima Italiana per la Fabricazione della Dinamite*, built a factory in Avigliana, outside Turin.

In Spain a new company, *Sociedad Española de Dinamita*, was formed in 1872. By the autumn of 1872, production began at a newly-built factory in Galdacano, outside Bilbao. Another factory was built in Trafaria, Portugal, outside Lisbon.

In Switzerland, the construction of the St. Gotthard Railway and the St. Gotthard Tunnel greatly increased demand for dynamite during the early 1870s. Paul Barbe was the driving force behind the formation of the company *Societé Anonyme Dynamite*, and a factory was built in Isleten in the canton of Uri.

Paris

In 1873, at the age of 40, Alfred Nobel purchased a residence in Paris. This was actually the first time he had setup a home of his own. Although he had maintained a home base in Hamburg during the years just prior to this move, he had spent most of his time traveling, and this residence seems to have had temporary function. He continued traveling extensively even after moving to Paris, but this home definitely seems to have provided a permanent base. It also finally reflected his economic, social and cultural status.

The house was on Avenue Malakoff (the name of which was later changed to Avenue Poincaré), not far from the park at Bois de Boulogne, the Arc de Triomphe and the Trocadéro gardens. He was likely attracted by the cultural opportunities and social life of such a large city, yet he also had business reasons for his move. Paris was the home of Nobel's important business partner Paul Barbe. Barbe is said to have convinced Nobel to move to Paris. The city's central location was also convenient for Nobel's many trips. From Paris, the distance to Glasgow and London was just as reasonable as to Hamburg, Vienna and Turin.

As befitted a well-to-do inventor and businessman, he had a household staffed with servants. He also employed a chemist, who worked in the laboratory connected to the house. Even so, he handled all of his own correspondence. Eventually he began looking for a suitable secretary with knowledge of several of the five languages in which he corresponded. In 1875 or 1876, Nobel placed an advertisement in a newspaper in Vienna, a city he sometimes visited and which seemed particularly cultivated. He received a reply from Bertha Kinsky von Chinic und Tettau.

Before she took up employment with Nobel, Kinsky had



Bertha von Suttner.

worked as a governess for a wealthy aristocratic family. She and a son of the family, Arthur van Suttner, had fallen in love. She was several years his elder and, even though she was an aristocrat, she was not wealthy. Though the relationship seemed impossible, the two were irresistibly drawn to

Alfred Nobel's Paris home had a conservatory.



Sofie Hess.

each other and after only a few weeks of working for Nobel, Bertha resigned, traveled back to Austria, and married von Suttner.

Nobel was once again alone with his flood of incoming and outgoing letters. He did not hire another secretary until the final years of his life. He and Bertha von Suttner maintained contact through correspondence. Her later involvement in the peace movement led Nobel to examine and challenge his own work, and he made monetary contributions to the movement.

The contemporary image of a wealthy and respected man of a mature age held that he should be married. Though Alfred Nobel never married, an important part of his life during his years in Paris was his 14-year relationship with an Austrian woman, Sofie Hess.

Alfred Nobel met Sofie Hess during a visit to Baden bei Wien in 1876. The relationship was anything but harmonious. For a while, he seems to have been happy and in love, despite all of his business worries. He soon became dissatisfied with the relationship but he did not seem to want to end it. He scolded her for being irresponsible and childish. Nonetheless, he confided in her and told her business secrets that were so sensitive that he later asked her to destroy his letters. Alfred and Sofie's drawn-out and uneasy relationship finally ended, and in 1890 Sofie became pregnant by another man, whom she eventually married.

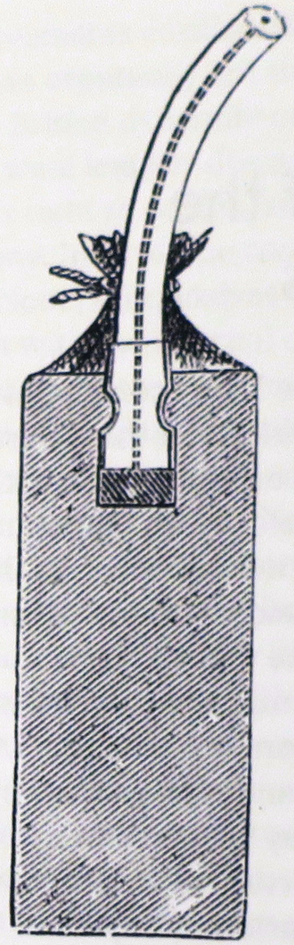
The end of the relationship with Hess coincided with business-related and other problems for Alfred Nobel. All these problems contributed to his purchase of a new home in San Remo, Italy, though he kept his house in Paris until his death.

Blasting Gelatin

Dynamite eliminated the worst risks of blasting oil while still retained most of its explosive power. Even so, Nobel continued searching for a safer and more effective explosive. He realized that it would be better to replace kieselguhr with something that amplified the power of the explosion. In 1845, Christian Friedrich Schönbein in Basel had invented another explosive substance, gun cotton or nitrocellulose, by allowing nitric acid react with cotton. The next logical step would be to combine nitroglycerin and gun cotton.

In the summer of 1875 Nobel came up with a solution. At the house he had recently bought in Paris, Nobel had cut his finger while working in the laboratory. To protect the wound, he brushed it with collodion, a thick semisolid that formed a membrane over the cut. That night, he was awaked by pain in his finger. He went down to the laboratory to brush a little more collodion onto the cut, and began thinking about how collodion was produced. Nitrocellulose was dissolved in ether and alcohol. When the ether evaporated, it left a jelly-like substance. Nobel had an idea. He made a little collodion and added a small amount of nitroglycerin. By varying the amounts of the different components, he found that he could modify the consistency of the mix.

When Nobel's assistant, the chemist Georges Fehrenbach, arrived at the laboratory in the morning Nobel told Fehrenbach that he might be close to discovering a new and even more effective explosive. Due to its consistency, the new explosive was called blasting gelatin. Eventually, though, it also came to be referred to as dynamite.



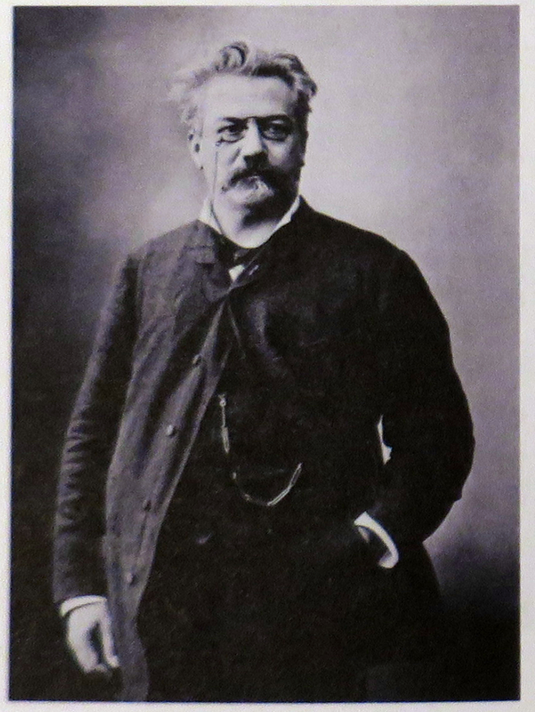
In some countries blasting gelatin was marketed as "Nobel's Extra Dynamite"



Reorganization of the Nobel Companies

By the mid-1870s, the largest of the Nobel companies had been established in different countries. But there were still problems. The Nobel companies were not in tune with the economic cycles, so it took time before they began making significant profits. Their organization was also less than ideal. They had been established under various circumstances, which were reflected in the way each one was set up. Alfred Nobel's desire to reorganize the companies led to conflicts with the company directors and the other owners.

While relations between Nobel and his German business partners may have been frosty, they were not easily broken. On the contrary, Nobel, Barbe, Carstens and Bandmann began to discuss integrating the various companies.



Paul François Barbe became Alfred Nobel's most important business partner.

Disagreements continued, though, and Nobel's German partners eventually left the company.

The British dynamite company also underwent changes. There were lengthy discussions about ownership structure, Nobel's right to profits, and how to restructure the company. In 1876, the company was reorganized under the name Nobel's Explosives Company.

Even with the internal competition between the Nobel companies, there were reasons for collaboration. Nobel, his assistant Georges Fehrenbach and Alarik Liedbeck brought improvements to the factories. To strengthen and coordinate these joint efforts, Nobel and Barbe formed a syndicate open to the companies in the different countries. The syndicate was to supply traveling engineers who would assist in the construction of new facilities and installation of new equipment and who would coordinate procuring raw materials. Some of the companies joined the syndicate, but in general interest was poor and it survived for only one year.

The Nobel companies were eventually linked more closely to one another. To put an end to the internal competition and gain benefits from cooperation, both Barbe and Nobel worked to merge the companies, though they followed different approaches. In 1885, the German Nobel company entered into a union with other German companies. In 1886, this union joined the British Nobel's Explosives Company to form the Nobel-Dynamite Trust Company.

The French, Spanish and Italian-Swiss Nobel companies did not join the trust. Instead Barbe reorganized these companies into what he called the Latin Trust or *Société Centrale de Dynamite*. The relationship between Nobel and Barbe was shifting and sometimes Nobel regarded Barbe's behavior as deceitful. However, Barbe remained Nobel's most important business partner until his death in 1890.



Sofie Hess.

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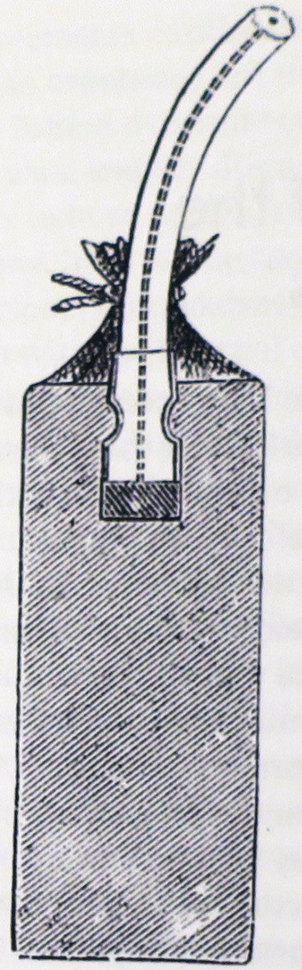
The end of the relationship with Hess coincided with business-related and other problems for Alfred Nobel. All these problems contributed to his purchase of a new home in San Remo, Italy, though he kept his house in Paris until his death.

Blasting Gelatin

Dynamite eliminated the worst risks of blasting oil while still retained most of its explosive power. Even so, Nobel continued searching for a safer and more effective explosive. He realized that it would be better to replace kieselguhr with something that amplified the power of the explosion. In 1845, Christian Friedrich Schönbein in Basel had invented another explosive substance, gun cotton or nitrocellulose, by allowing nitric acid react with cotton. The next logical step would be to combine nitroglycerin and gun cotton.

In the summer of 1875 Nobel came up with a solution. At the house he had recently bought in Paris, Nobel had cut his finger while working in the laboratory. To protect the wound, he brushed it with collodion, a thick semisolid that formed a membrane over the cut. That night, he was awaked by pain in his finger. He went down to the laboratory to brush a little more collodion onto the cut, and began thinking about how collodion was produced. Nitrocellulose was dissolved in ether and alcohol. When the ether evaporated, it left a jelly-like substance. Nobel had an idea. He made a little collodion and added a small amount of nitroglycerin. By varying the amounts of the different components, he found that he could modify the consistency of the mix.

When Nobel's assistant, the chemist Georges Fehrenbach, arrived at the laboratory in the morning Nobel told Fehrenbach that he might be close to discovering a new and even more effective explosive. Due to its consistency, the new explosive was called blasting gelatin. Eventually, though, it also came to be referred to as dynamite.



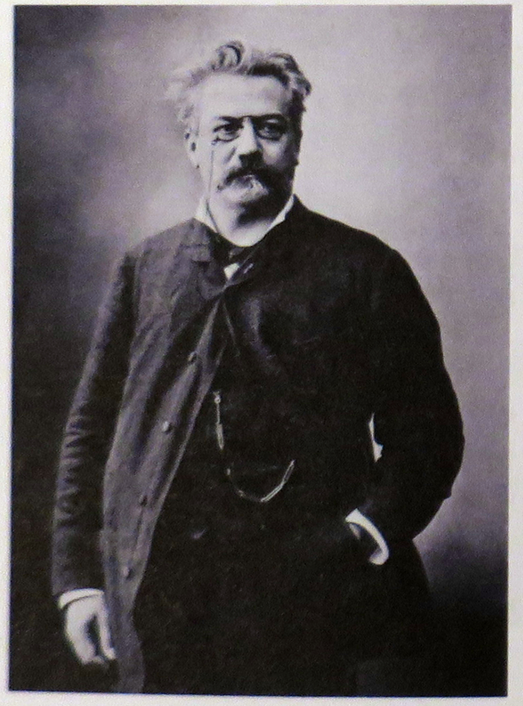


In some countries blasting gelatin was marketed as "Nobel's Extra Dynamite"

Reorganization of the Nobel Companies

By the mid-1870s, the largest of the Nobel companies had been established in different countries. But there were still problems. The Nobel companies were not in tune with the economic cycles, so it took time before they began making significant profits. Their organization was also less than ideal. They had been established under various circumstances, which were reflected in the way each one was set up. Alfred Nobel's desire to reorganize the companies led to conflicts with the company directors and the other owners.

While relations between Nobel and his German business partners may have been frosty, they were not easily broken. On the contrary, Nobel, Barbe, Carstens and Bandmann began to discuss integrating the various companies.



Paul François Barbe became Alfred Nobel's most important business partner.

Disagreements continued, though, and Nobel's German partners eventually left the company.

The British dynamite company also underwent changes. There were lengthy discussions about ownership structure, Nobel's right to profits, and how to restructure the company. In 1876, the company was reorganized under the name Nobel's Explosives Company.

Even with the internal competition between the Nobel companies, there were reasons for collaboration. Nobel, his assistant Georges Fehrenbach and Alarik Liedbeck brought improvements to the factories. To strengthen and coordinate these joint efforts, Nobel and Barbe formed a syndicate open to the companies in the different countries. The syndicate was to supply traveling engineers who would assist in the construction of new facilities and installation of new equipment and who would coordinate procuring raw materials. Some of the companies joined the syndicate, but in general interest was poor and it survived for only one year.

The Nobel companies were eventually linked more closely to one another. To put an end to the internal competition and gain benefits from cooperation, both Barbe and Nobel worked to merge the companies, though they followed different approaches. In 1885, the German Nobel company entered into a union with other German companies. In 1886, this union joined the British Nobel's Explosives Company to form the Nobel-Dynamite Trust Company.

The French, Spanish and Italian-Swiss Nobel companies did not join the trust. Instead Barbe reorganized these companies into what he called the Latin Trust or *Société Centrale de Dynamite*. The relationship between Nobel and Barbe was shifting and sometimes Nobel regarded Barbe's behavior as deceitful. However, Barbe remained Nobel's most important business partner until his death in 1890.

The Oil Industry in Baku

Though Alfred Nobel's dynamite companies were the dominant part of his business, there was a significant side venture, the oil industry in Baku, in present-day Azerbaijan, which in Nobel's day was part of the Russian Empire. His brothers Robert and Ludvig played important roles in this business.

After Immanuel Nobel's business in St. Petersburg had gone bankrupt, Ludvig succeeded in rebuilding the family business, in part, through supplying large orders for rifles to the Russian army. Robert was setting up a company to manufacture rifle stocks and in 1873 he went to the Caucasus to look for walnut wood for the stocks. The walnut trees turned out to be a disappointment, but he saw an opportunity in oil wells in Baku.

Robert's knowledge of chemistry helped him make high quality products that did very well on the market, but he lacked financial resources and needed help expanding the business. Ludvig invested considerable sums to this end and Alfred also contributed money. The brothers invested their knowledge in the business, too. Ludvig drew up plans for a more modern system of transporting oil. Alfred knew the chemical industry and had valuable contacts and considerable experience in business processes and in how to organize companies.

Operations in Baku expanded, but disputes arose between the brothers on several occasions. Eventually, Robert withdrew from the company and moved to Sweden. Alfred was critical of the company's financial management and felt that Ludvig was expanding the business too quickly. He expressed doubts even after Ludvig died in 1888 and his son Emanuel took over the company. Alfred's doubts,



Ludvig and Robert Nobel.

however, at least to some extent proved groundless. The Nobel Brothers Naphtha Company survived, producing healthy profits at times.

The oil fields in Baku.

Ballistite

With the introduction of blasting oil, dynamite and blasting gelatin, Alfred Nobel had developed superior alternatives to black powder as a blasting agent. He wondered whether nitroglycerin might even be used as an alternative to black powder in weapon ammunition, but attempts to use dynamite in artillery ammunition were not especially successful. Dynamite was far too powerful for use in ammunition.

Black powder created heavy smoke when firing shots. This was a problem, in part, because it made seeing the target difficult and, in part, because the smoke revealed the location of the shooter or the artillery piece. There would be a large market for a powder that created less smoke, both in military and civilian applications.

Throughout Europe, numerous chemists were working on the problem, including Nobel. He conducted most of this work in Sevran, outside Paris, where he had bought a piece of property to use as a laboratory in 1881. In 1887, he was ready to apply for a patent for a reduced-smoke powder. As with blasting gelatin, this new substance was a mixture of nitroglycerin and gun cotton. Nobel called it ballistite.

During the later phase of developing the product, Nobel collaborated with Frederick Abel and another British chemist, James Dewar. The two British chemists ended up introducing a competing version of smokeless powder under the name cordite. At the same time, another version of smokeless powder, Poudre B, was developed in France by the chemist P.M.E. Vieille.

These other smokeless powders caused Nobel many problems. In the UK, the introduction of cordite resulted in a lengthy patent dispute that was referred to as the Cordite Process. In France, Nobel was suspected of having stolen



Fig. 1.—FIRING A VOLLEY WITH COMMON POWDER.

Fig. 2.—FIRING A VOLLEY WITH SMOKELESS POWDER.

Illustration of smoke created by black powder and smokeless powder, respectively.

his invention from the French army's laboratories in Sevran. This was one of the major reasons for his move to San Remo, Italy.

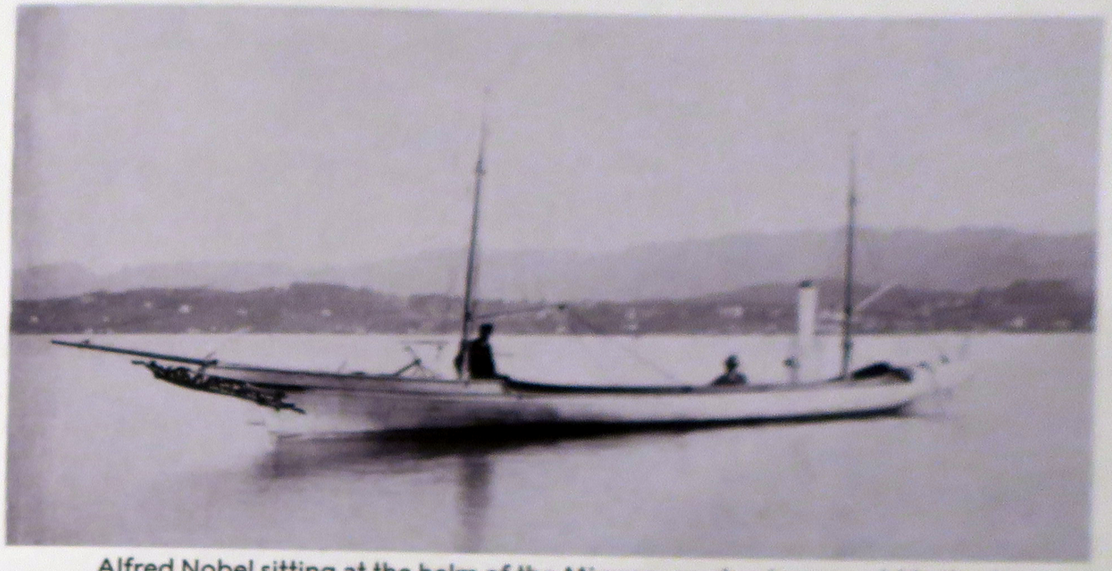
Later Projects

During the 1860s and 1870s Alfred Nobel's major focus was on explosives, but he also examined other technical problems. During the 1890s, his attention turned to a wide range of areas. Some of the projects Nobel pursued, in addition to explosives, had a connection with the production processes used in his explosives factories. For example, he worked on ways to concentrate sulfuric acid and developed new refrigeration machines. He also worked on a number of issues in the petroleum industry where he and his brothers were active. This included developing improved burners for lighting oils and better methods of refining oil.

A spin-off of his work with gun cotton or nitrocellulose was the development of substitutes for rubber, leather and silk. Nobel even introduced a number of innovations in artillery and firearms. These included silent rifles, production methods for cannon barrels, rocket-propelled projectiles and ignition tubes for projectiles. Other projects, such as the development of explosion-proof steam boilers and methods for refining pig-iron, were probably also related to his experiments in weapons technology. His interest in ammunition and weapons technology is why Nobel bought



One of the industrial projects Alfred Nobel was involved in was the Svea Velocipede, a multi-geared bicycle developed by Birger and Fredrik Ljungström.



Alfred Nobel sitting at the helm of the Mignon, an aluminum yacht he had built for his own use.

the weapons factory in Bofors, outside the town of Karlskoga in western Sweden, in 1893.

Nobel was also interested in a new metal called aluminum. Household items of aluminum were first seen at the 1889 World's Fair in Paris. In 1891, Nobel had the world's first aluminum-hulled boat built.

Nobel also invested in other industrial projects, even though he did not participate in the actual research and development. In Sweden, he helped establish an electrochemical company that extracted sodium hydroxide and chlorine from salt. He was also the major backer in the development of the Svea Velocipede, the first bicycle with multiple gears.

Nobel was actively interested in medical research. Around 1890, through a professor at the Karolinska Institute in Stockholm, Nobel came into contact with a physiologist who was seeking collaborators for various projects. One of Nobel's motivations for this was that had begun experiencing heart problems in the late 1880s. Physiologist Jöns Johansson worked at Nobel's laboratory in Sevran for a time in 1890 and pursued a number of experiments in the laboratory, including some attempts at blood transfusions.

Alfred Nobel's laboratory
in San Remo.

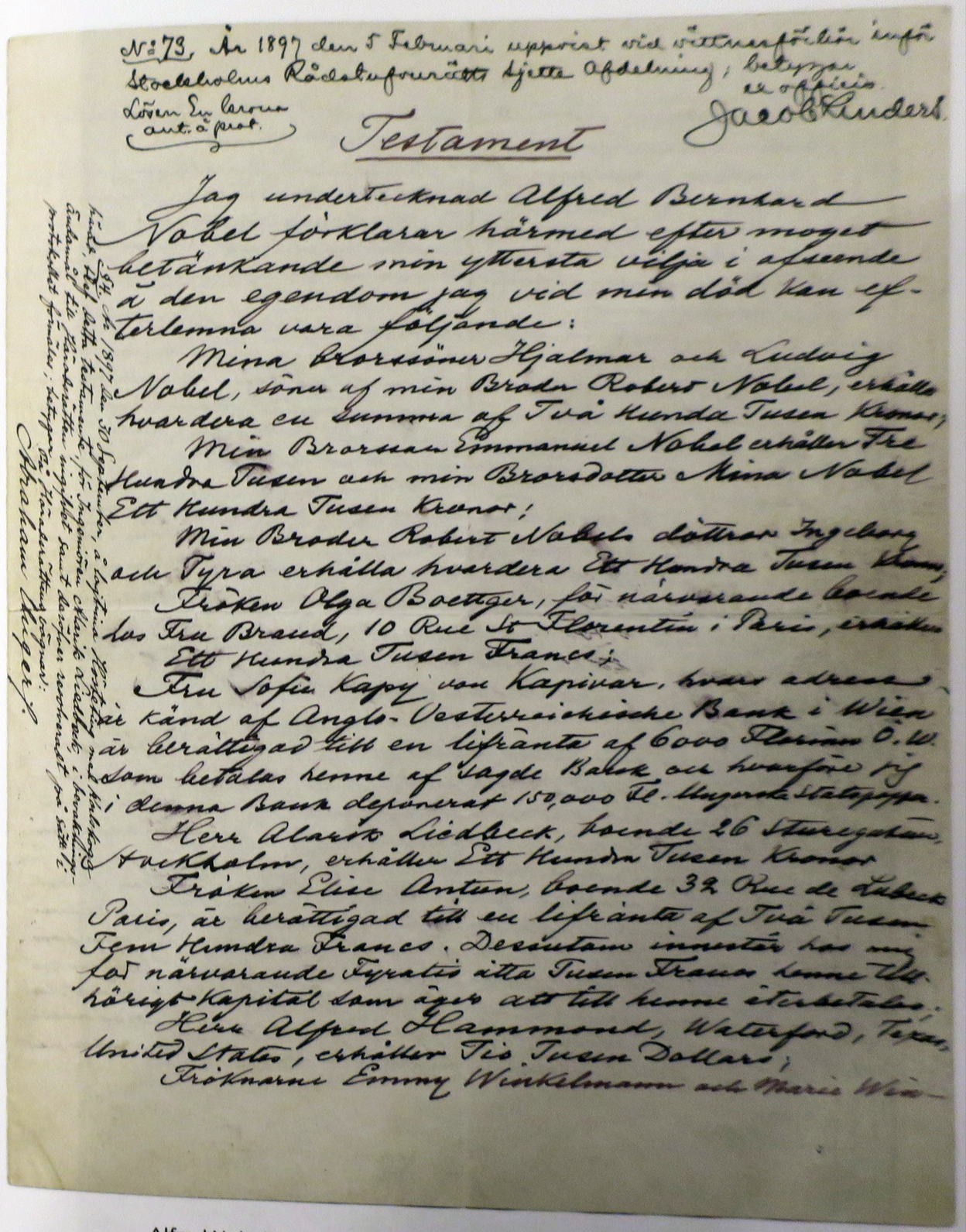
The Will

On November 27, 1895, Alfred Nobel completed his most famous contribution to posterity – his will. In it, he stipulated that the majority of his fortune be used for prizes in five fields: physics, chemistry, physiology or medicine, literature, and peace.

Nobel's will was the result of the circumstances in his personal life, including his family relationships, his health and his state of mind. It also grew out of his life's work, his interests, and his values. In a broader perspective, Nobel's will is also a reflection of the times in which he lived and of the thinking and ideas of the day.

His will provided his six nieces and nephews with sums that were significant by the standards of the day. Fourteen other individuals were also noted in this will. The remainder of Nobel's fortune was to go toward the prizes:

"The whole of my remaining realizable estate shall be dealt with in the following way: the capital, invested in safe securities by my executors, 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 litera-



Nº 73. År 1897 den 5 Februari upprättat vid Vittnesförhör inför Stockholms Rådstufvurätts Sjette Afdelning; hvarvid Löjtnanten Emanuel Nobel förordnades att vara Notarius Publicus ad actum.

Testament

Jag undertecknad Alfred Bernhard Nobel förklarar härmed efter moget betänkande min yttersta vilja i afseende å den egendom jag vid min död kan efterlemna vara följande:

Mina Brorssöner Hjalmar och Ludvig Nobel, söner af min Broder Robert Nobel, erhålla hvardera en Summa af Två Hundra Tusen Kronor;

Min Brorsson Emmanuel Nobel erhåller Tre Hundra Tusen och min Brorsdotter Nina Nobel Ett Hundra Tusen Kronor;

Min Broder Robert Nobels döttrar Ingeborg och Tyra erhålla hvardera Ett Hundra Tusen Kronor;

Fröken Olga Boetger, för närvarande boende hos Fru Braud, 10 Rue St Florentin i Paris, erhåller Ett Hundra Tusen Francs;

Fru Sofia Kapy, von Kapivar, hvars adress är känd af Anglo-Oesterreichische Bank i Wien är berättigad till en liffränta af 6000 Reichsmark o. w. som betalas henne af Sagde Bank och hvarför mig i denna Bank deponerat 150,000 Rl. Mynkabetalppapper.

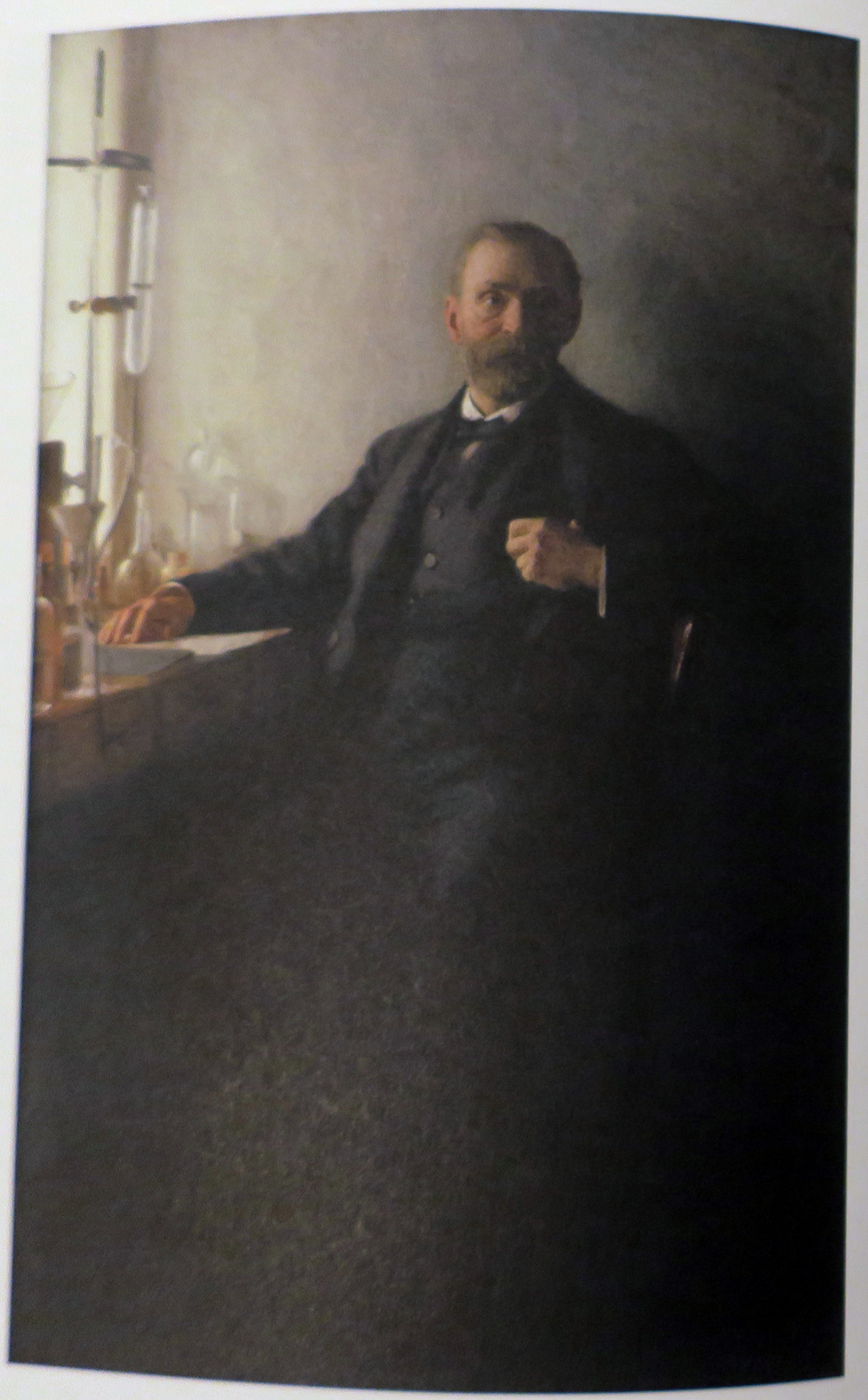
Herr Alarik Liedbeck, boende 26 Sturegatan, Stockholm, erhåller Ett Hundra Tusen Kronor;

Fröken Elise Antoni, boende 32 Rue de Labeck Paris, är berättigad till en liffränta af Två Tusen Fem Hundra Francs. Dessutom innestår hos mig för närvarande Depositionen Ett Tusen Francs hennes tillhörigt Kapital som ägare att till henne återbetalas;

Herr Alfred Hammond, Waterford, Texas, United States, erhåller Tio Tusen Dollars;

Fröknarne Emmy Winkelmann och Marie Win-

Alfred Nobel's will.



ture 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 between nations, for the abolition or reduction of standing armies and for the holding and promotion of peace congresses. The prizes for physics and chemistry shall be awarded by the Swedish Academy of Sciences; that for physiology or medical works by the Karolinska Institute in Stockholm; that for literature by the Academy in Stockholm, and that for champions of peace by a committee of five persons to be elected by the Norwegian Storting. It is my express wish that in awarding the prizes no consideration be given to the nationality of the candidates, but that the most worthy shall receive the prize, whether he be Scandinavian or not."

The prize areas reflected Nobel's ideas and interests. Chemistry was the most important science for Nobel's own work. Physics was closely linked to chemistry and was a highly regarded science. Nobel also had an active interest in medical research, perhaps partly because of his hypochondria. During his early youth he had developed an interest in literature that lasted throughout his life. During the last years of his life, he began writing again. The use of his inventions in warfare had given him reason to think about peace and his acquaintance with Bertha von Suttner certainly strengthened his involvement in the peace movement.

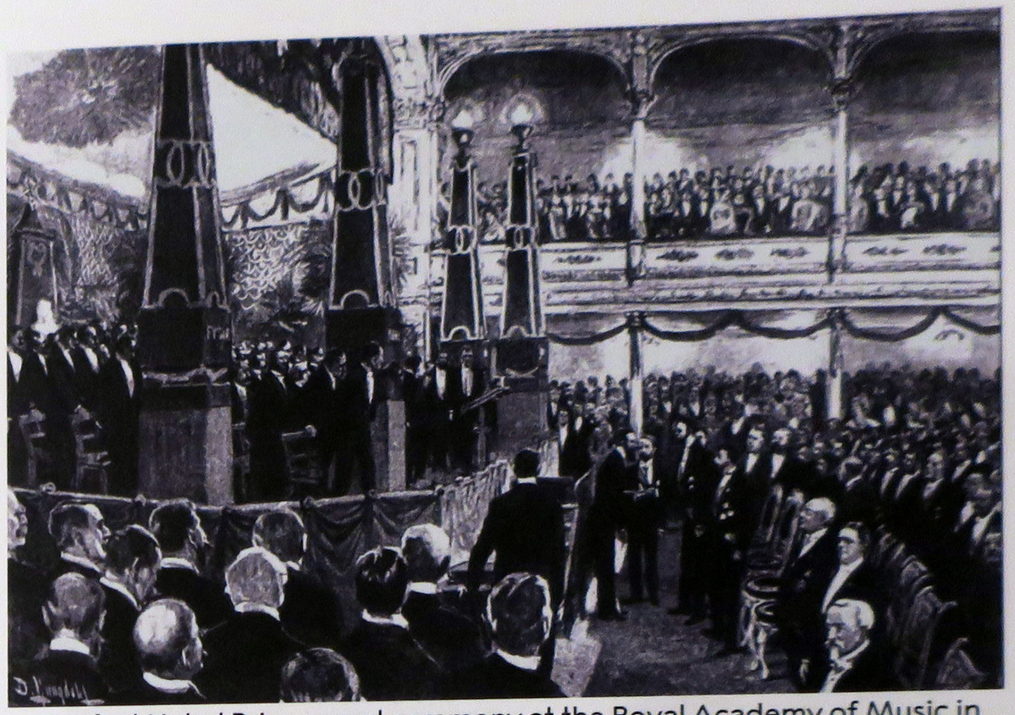
< Alfred Nobel. Oil painting by Emil Österman painted after Nobel's death.

The Nobel Prize

During the autumn of 1896, Nobel was still very active with his travels and his correspondence, but he complained of his failing health, and in December of that year, his condition worsened. He died in San Remo on December 10, 1896. Several days after Nobel's death, his will was read. The formulations about the prizes were brief and, from a legal perspective, the will was unclear, resulting in a long, drawn out process to realize his wishes. A driving force in this work was Ragnar Sohlman, who Nobel had hired as his assistant a few years earlier and who he had appointed as one of the executors of his will.

Numerous parties, including some family members, presented the will's legal shortcomings as arguments for why Nobel's relatives and the institutions named in the will should be allowed to decide how to distribute the estate. There were mixed reactions to Nobel's will in public circles, as well. Many newspapers viewed it as a magnanimous gift to humanity, while others were more skeptical. At the time, Sweden had strong nationalistic tendencies, and many saw the international nature of the prizes as dubious. The requirement that the Peace Prize be awarded by Norway's parliament, the Storting, was regarded as particularly problematic, because the political union between Sweden and Norway had begun to unravel.

Ragnar Sohlman and his colleagues had many obstacles to overcome. One problem at the outset, particularly in France, was that taxes and fees threatened to consume a significant portion of the estate. One of the first tasks Sohlman undertook was to collect Nobel's resources in various countries, send them to Sweden, and carry out the legal proceedings there. To do this, the executors had to



The first Nobel Prize award ceremony at the Royal Academy of Music in Stockholm in 1901.

prove that Nobel was a resident of Sweden, not an entirely clear-cut matter. Nobel had not lived in Sweden for many years. Ragnar Sohlman and his assistants argued that Nobel had resided in Bofors, where he had purchased a home. In the end, the legal proceedings took place in the nearby city of Karlskoga.

It proved no easy task to convince the institutions named in the will that they should award the prizes. The Norwegian Storting soon announced that they would accept the charge. The Royal Swedish Academy of Sciences, the Swedish Academy and the Karolinska Institute, however, hesitated to take on the huge responsibility of selecting the most worthy recipients for the prizes. Only after extensive discussions did all of the institutions agree to the new responsibilities.

Once this was accomplished, a fund needed to be created in which Nobel's remaining fortune would be collected once his stocks, bonds and other securities had been converted into cash. In 1900, the Nobel Foundation was established and given the responsibility of administering Nobel's fortune and organizing the awarding of the prizes.

The detailed guidelines for the selection of the prize recip-

ients also had to be determined. The result was an ambitious and complex procedure for each of the prizes. It was decided that a committee for each prize area would perform the preparatory work. The committees would gather nominations from experts in different areas. Based on the nominations received and further studies, the committees would make the most well-informed decisions possible for each prize-awarding institution.

In 1901, five years after Alfred Nobel's death, the first Nobel Prizes were awarded. The statues of the Nobel Foundation established that, in addition to a monetary award, each laureate would receive a medal and a diploma.

Would Alfred Nobel have been remembered if he had not established the Nobel Prizes? Perhaps, and certainly the name of his most famous invention–dynamite–would have been remembered.

The companies Nobel established continued and grew. Explosives production continued to increase. Through the establishment of new companies, buyouts and mergers with other companies, the number of factories connected with the Nobel name also increased. By the time of Nobel's death in 1896, there were Nobel companies in twenty countries, with a total of almost 100 factories. Many of the world's explosives manufacturers today have direct or indirect roots in the companies started by Nobel.

Alfred Nobel's inventions revolutionized the technology of explosives. Even so, his most lasting contribution to the world was his will and its results–the Nobel Prizes.



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At the Nobel Prize Museum, you will learn more about the Nobel Prize and its founder, as well as the Nobel Laureates and their creative endeavors. The Nobel Prize Museum's aim is to spread knowledge as well as to create interest and discussion around science and culture through creative learning and exhibition techniques, modern technology and elegant design.

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