

WERNER A VON SIEMENS BRIMMING SPIRIT

Z LETTERS



A MODERN ENTREPRENEURIAL HISTORY
EDITED BY NATHALIE VON SIEMENS

MURMANN
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WERNER VON SIEMENS
CHRONOLOGY

BRIMMING SPIRIT

1822
Michael Faraday discovers that electricity can be produced from magnetism.

1834
Werner goes to Berlin. He's attracted by the great minds of the natural sciences.

1846
Werner and Johann Georg Halske meet on New Year's Eve. They bond over a modified cigar box.

1835
Werner attends the Artillery and Engineering School in Berlin. His years there are among the «happiest» of his life.

1847
Siemens and Halske start their company in a back yard in Berlin with global ambitions.

GLOBAL AMBITION

1849
Breaking news: A message is sent on the new telegraph line between Berlin and Frankfurt am Main.

1853
Werner's first son is born. He is there for the birth in Berlin.

1852
The first trip to Russia. Werner wants to conquer a new market.

RUSSIAN OVEN

1852
Marriage to Mathilde Drumann. Werner, the «Russian oven,» starts a family.

1865
Mathilde dies on July 1. A tremendous blow for Werner, from which he does not recover for some time.

1816
Ernst Werner Siemens is born on December 13 in Lenthe in Lower Saxony.

1892
The letters stop coming. Werner von Siemens dies on December 6.

1851
The World Exhibition in London's Hyde Park. The pointer telegraph from S&H attracts plenty of attention.

1851
The Nottebohm crisis: Werner falls out of favor with the Prussian government official Friedrich Wilhelm Nottebohm—and loses an important customer.

1849
Werner takes his leave of the military and resigns his post as the head of the Prussian state telegraph.

1856
S&H employs over 330 people. Two-thirds work in Russia.

1859
Werner visits the pyramids in Egypt. He shocks locals with a «godless experiment.»

1869
Werner marries Antonie Siemens, a distant relative from Swabia, on July 13.

1874
Confirmation of Werner's daughter Anna. Werner writes an emotional letter from London.

1863
Halske announces his departure from the operational side of the business. He remains a friend and advisor.

1869
Werner gives the Berlin Zoo a billy goat as a gift. The animal is a «souvenir» from the Caucasus.

1865
The English business is renamed «Siemens Brothers,» which William runs from London.

1870
William Siemens unveils a Siemens sensation: The 11,000-kilometer telegraph line from London to Calcutta is opened.

1866

Werner has an idea and discovers the dynamo-electric principle.

1872

Social responsibility: A pension fund for employees, widows, and orphans is introduced at S&H.

1874

Faraday is launched in Newcastle. The state-of-the-art ship is made for laying cable in the Atlantic.

1880

Werner envisions an electric elevated railway for Berlin that is not implemented.

1881

Siemens & Halske begin production of incandescent light bulbs.

1879

Siemens & Halske introduces a global sensation at the Berlin Trade Fair: the first electric railway.

1887

Werner's efforts lead to the opening of the Physico-Technical Imperial Institute.

1888

Werner Siemens is given a noble title and from then on carries «von» in his name.

1890

S&H becomes a limited partnership. Carl Siemens and Werner's sons Arnold and Wilhelm are the partners.

**A
BRIMMING
SPIRIT**

WERNER
A^{VO}N SIEMENS
BRIMMING
SPIRIT
Z LETTERS

A MODERN ENTREPRENEURIAL HISTORY,

EDITED BY

Nathalie von Siemens

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A Siemens Stiftung project in commemoration of Werner von Siemens' 200th birthday. This book is based on countless letters to and from Werner von Siemens, which are archived in the Siemens Historical Institute and were made fully available to us. I would like to extend my sincerest thanks to the Siemens Historical Institute for its cooperation during all stages of this project. In the interest of readability, the writing style of the original letters has been adapted to modern spelling. Special thanks to Bodo von Dewitz, Marie von Dewitz, H.W. Pausch, and Philip M. Remy for their contributions and access to photos of the von Siemens family.

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DEDICATION

For all inventors, creators, start-up entrepreneurs, professional and hobby historians, nerds, app searchers, management novices, technology aficionados, 24-hour Tweeters, perma-Snapchatters, co-workers, new workers, old workers, algorithm junkies, cloud users, young, old and family entrepreneurs, innovation specialists, design-thinking wayfarers, social entrepreneurs, early adopters, corner office occupants, cubicle workers, start up accelerators, friends of industry 4.0, data analysts and scientists, system engineers, CEOs, CIOs, CFOs, COOs, CDOs, CTOs, CMOs, serial entrepreneurs, angel investors, early stage and other investors, electronic car drivers, technology enthusiasts, digital transformers, benchmark setters, selfie-takers, PowerPoint apostles, telco fans, art book lovers, for those who switch on the light in the morning and rush to the subway, for those who network, and for those who have often asked themselves the question, how did it all begin ...

LIVELY CORRESPONDENCE

Foreword

If we assume that Werner von Siemens needed about 15 minutes for one handwritten page, then between his 30th birthday and the end of his life—a period that included around 9,000 letters of comprehensive private correspondence—he must have spent three to four hours per day writing and reading letters. Even when his travels took him far away, as was often the case, it was important for him to stay in touch. People meant something to him, especially the members of his family.

In his letters, Werner shared thoughts, questions, and concerns; expanded upon ideas and discoveries; and gave advice and instructions. He is critical and agitated; conflicted, and reconciled again; he speaks of happiness and joy, but also of pain and sadness. Simply put, a brimming spirit. The replies he received—sometimes critical—prompted a fresh response and new exchange. An ongoing dialogue was part of his essence as a person, and part of the secret to his success. Without the people around him, who encouraged him to embark on his unpredictable and tumultuous path, he would not have made it: the teacher who nurtured his talent; the cousin who acted as angel investor and propped up a risky start-up; and especially his first wife Mathilde, who stood by his side in times of trouble. And, of course, his brothers: Werner's most important partners after Johann Georg Halske.

In reading his letters, I have come to reacquaint myself with my great-great-grandfather. I was moved by the depth he showed, particularly in the letters to his wives. I was touched by his self-deprecating humor, which emerged even in the midst of the biggest crises. I have no doubt that these qualities are among those that made him so successful, more successful than so many other gifted inventors and entrepreneurs of his time. Part of his drive came from the sheer joy of a successful experiment and the new opportunities stemming from science and technology. His biggest motivator, however, was the desire to apply science and technology to create

practical benefit for other people, for society, and beyond the borders of Germany. This vision is among the reasons that a start-up in a back yard in Berlin became one of the world's most successful «stay-ups.»

Applying science and technology for the practical benefit of others—Siemens Stiftung feels strongly connected to this heritage. As a non-profit corporate foundation, we are committed to sustainable social development. This is dependent on access to basic services, high-quality education, and an understanding of culture, which can be self-sufficiently and sustainably achieved with the help of entrepreneurial approaches. We can all encourage the brimming spirits among us to follow their path.

This edition of letters, published to mark the occasion of Werner von Siemens' 200th birthday, is not an attempt at biographical completeness. A dedicated group of Siemens Stiftung representatives, historians, authors, and editors compiled a collage that invites the reader to join Werner von Siemens on his entrepreneurial journey, and to become inspired from his story. After all, entrepreneurs are working as hard as ever today. We've created a completely new way of speaking for the explosion of possibilities and challenges of our time: disruptive technologies, global networking, dynamic start up scenes, industrial paradigm shift, acceleration, transformation of work, and so on. Werner von Siemens experienced it all back in the 19th century—decisively shaping the leap into modernity.

Sincerely yours,
Nathalie von Siemens

BRIMMING SPIRIT

Great innovations

It is a dynamic age. Young Werner has no interest in learning Greek or Latin — it is technology that fascinates him. He is enamored with physics and electrical engineering, meets like-minded people, breaks new ground, and attempts daring experiments.

He lays the foundation for a global enterprise, driven by the desire to provide for his family, to be successful, and to create something meaningful.



COURAGEOUS, circa 1855



CONFIDENT, circa 1860

FINALLY, A SOLID FOOTHOLD

A spirited go-getter like Werner Siemens needs a stable foundation of science, like-minded contemporaries, and most importantly, experiments that work — such as gold-plating.

Werner is onto something. *I am indeed now quite determined to build a solid career in telegraphy*, Werner writes his brother William. His will is strong, and his CV at this point is rather modest: he had gilded a spoon in Magdeburg, created fireworks in Spandau, and had been awarded a patent for artificial stones made of siliceous earth. That's when it appears — his calling: *At some point, you must find a solid foothold somewhere*, he continues in the letter.¹ He sees his chance in telegraphy. He isn't married, he lives with his younger brothers in a shared apartment, and professionally — well, long-term career planning isn't his forte. But the telegraph fascinates him, and this could be his ticket. In an otherwise depressing letter on January 3, 1847, to his brother William, Werner writes: *But the gloomy mood has been lessened by the new path I chose for myself on my 30th birthday. I've disposed of all the sanguine hopes and intersecting plans over the years, and now, along with your council, would like to devote all my strength to my goal, electric telegraphy, and everything that it relates to and impacts!*²

Werner retires from the company in 1890 — following more than 40 years as a highly successful businessman, great inventor, trailblazer of modernity, and globally-celebrated technology virtuoso. He also turns over the management of the company to his brother and two sons and begins writing his memoirs. He develops an almost literary ambition, composing a truly illustrative and often tongue-in-cheek history of his early years up until his 30th birthday. His »Lebenserinnerungen« (»Recollections«) are published two years later. His memoirs retrospectively underscore a certain element of inevitability in his life story. On the subject of gold, for example.

GILDING THE SPOON

Werner writes in his memoirs of sitting in a military prison cell in Magdeburg where he had constructed a small laboratory with

THE GOLDEN SPOON In 1842, Werner sold a patent to a jeweler — and immediately reinvested his return.



tubes and beakers, and in this «isolation,» attempts electrolytic gold plating — trying to turn a silver spoon into a gold one. What comes across in his memoirs as a sinister tale of dark alchemy is actually the best kind of research. *I believe it was one of the happiest moments of my life when a German silver teaspoon, which I had dipped into a beaker filled with a solution of hyposulfite of gold and connected with the zinc pole of a Daniell cell, while the copper pole was connected with a louis d'or as anode, changed in a few minutes into a golden spoon of the finest and purest luster.*³

THE TRUE STORY

In reality, Werner isn't sitting in jail — the gold-plating took place long before his days in the slammer in the spring of 1842. In January of the same year, a patent had already been registered in Wittenberg for the «method of dissolving gold for the purpose of wet gold-plating through galvanized current» — to Werner Siemens. The romantic story of how he builds an anode from a French gold coin, the louis d'or, and connects it with a copper terminal, does in fact take place. It earns him his first patent, for

which he worked and experimented very hard — just not in a military prison.

Yes, Werner does spend time in jail, but just for a few weeks. What for? His imprisonment is due to the soldier's life he leads from 1840 as an officer in the garrison at Wittenberg — or to be more precise, the many quarrels that often escalate into rowdy behavior. While wounded pride often plays a role in these conflicts, the adversaries often see no other way to settle the score than with a strictly-forbidden duel. Young Werner often officiates in these confrontations. Everybody knows that any violation of the ban will be harshly punished, and the sentence imposed immediately. For Werner, that ends up being a few weeks in the clink — a sentence far less than feared, and far less than suggested in the dramatic lines of his memoirs. He is even given early release — making it sound more like a comedic sideshow than anything else.

HE'S IN BUSINESS

Even if his attempt at gold-plating is embellished, it is the message that matters. The [finest and purest luster](#) proves he can do it — discover, blaze new trails, and take risks. Research and experimentation are his passion, and they were done with an eye toward success, as was the case with the spoon. A jeweler in Magdeburg buys a license for Werner's gold-plating technique, and Werner is in business for the first time. Perhaps this is the first sign of his later success, but he can't say for sure just yet. Nonetheless, his curiosity, his strong will, his confidence in himself and in his abilities are the best qualifications he has in pursuing greater heights. He writes his brother Carl a few years later: [It's quite a thing, this drive to research: it works like an emotion, overcomes all obstacles and suppresses all other interests in one jolt. A successful and anticipated experiment brings more joy than hundreds of thousands in profit!](#)⁴

WERNER AND THE FANCY FIREWORKS

After the brief stint in the military prison, Werner moves to Berlin Spandau and lands in a department at a pyrotechnic factory that, at the time, bore the apt name: «Fancy Fireworks.» From 1842, Werner is free to quietly work on firecrackers and rockets made for public displays — including his successful show for the Empress of Russia's birthday. His pyrotechnic debut shows what Werner is capable of, even if the path toward what would become his company is not yet clear. The path to success is rarely straight, and often takes detours. And as they say, detours expand the knowledge of your surroundings.

IN NEED OF AN IDEA

The fireworks keep him moving forward: *With the letting off of these fireworks my command of the pyrotechnic factory came to an end, and to my delight I was ordered to Berlin for service in the ordnance department. Through this transfer my greatest wish was fulfilled, to obtain time and opportunity for further scientific studies and for increasing my technical knowledge,* he writes in his memoirs.⁵ But just a short time later, he finds himself wrapped up in a bit of a political and religious controversy along with some of his comrades. As punishment, the officers at the ordnance department where Werner works as a scientist are sent back to their units. *We soon learned that as punishment we were all to be sent back to our brigade. [...] The problem was to find a way to prevent this removal. That was only to be attained by an important military discovery, which should necessitate my presence in Berlin. Telegraphy [...] could not perform this service, for only few then believed in its great future, and my projects were still undeveloped.*⁶

By this time, Werner has already developed a passion for the telegraphy. The Prussian capital seems to be a better starting point

for his research, and under no condition does he want to go back to Wittenberg. The pressure is on for something to happen.

CAN'T IS NOT A WORD

The way around the problem is gun cotton. The material is said to create a stronger explosion than gunpowder, but it doesn't keep as long and decomposes quickly. Werner's plan is to make gun cotton keep longer. He experiments with nitric acid and sulfuric acid and manages to create a product that is both long-lasting and highly explosive. There is plenty of interest from the war ministry, where a lot of hope is placed on the discovery. More importantly, his disciplinary transfer back to Wittenberg is no longer an issue. Werner is to remain in Spandau and keep up his research on gun cotton. Mission accomplished, or as Werner puts it: [Just avoid saying that fatal word: can't!](#)⁷



YOUNG WERNER'S HOME The Menzendorf estate in Mecklenburg country, which offered no material for thought and positive knowledge, 1910

A GIFTED BOY

The Bauakademie (Academy of Architecture) in Berlin draws Werner to the big city to join other important minds of the time in their studies. The bar is high — but there is a way.

From his birth in December 1816 in Lenthe, success is not a given for Werner. His parents have 14 children: 11 sons and three daughters. Their father is only moderately successful as a farmer, and while the family never went hungry or lived in want, Werner never seems to have a very happy childhood or youth. Later, he writes to his first wife Mathilde on the matter, saying how joyless and somber his youth had been.



WHERE WERNER LONGED TO BE Berlin's Bauakademie (Academy of Architecture)
by Karl Friedrich Schinkel, 1836

But the gifted boy has the will to learn, in particular about the sciences. The world is in the midst of a new age, one of industrialization and of technical innovation. Meanwhile, his father had rented a farm, a so-called «Domäne» (agricultural estate) in the Mecklenburg region. Werner likely deduces that there could be methods, techniques, and machines, that can replace manpower and make a new form of production possible. It is a taste of his future, which must have seemed quite far away from his father's poor agricultural estate. Werner's father works himself to the bone, from morning till night, but can never manage to get ahead.

«NO MATERIAL FOR THOUGHT»

His parents see that their son is gifted and that he needs guidance, stimulation, and education, the latter of which is of great importance in his parent's Protestant home. They send him

to a secondary school in Lübeck, an institution in the humanistic tradition. Rather than introducing the pupils to science, the teachers focus mostly on the classical languages, Latin and Greek. The students cram vocabulary, sentence structure, and grammar rules, **which offered no material for thought and positive knowledge**, as Werner later writes in his memoirs, ever biased, even in reflection.⁸

At 17, he finally has enough of this humanistic school—and decides upon his first goal. He wants to attend the Bauakademie in the Prussian capital, where famous men teach science and its practical application.

A SCHOOL LIKE DONNERHALL

At Easter, 1834, Werner leaves his parent's house in Mecklenburg and heads to Berlin. At the Bauakademie, an ultramodern new building is being built based on plans by the famous architect and artist, Karl Friedrich Schinkel. The building is constructed in the style of English industrial buildings, with an exterior of red, exposed bricks. The construction and execution of the project is considered revolutionary for the time. The spirit of the technological avant-garde, which Werner yearns to be a part of, is literally built into the scenery. The only problem is that he cannot afford to study at the Prussian Bauakademie.

But Werner, who dreams of technological innovations in the provinces of northern Germany, has luck on his side. During his time at school in Lübeck, he takes private lessons in «field surveying» from a teacher who previously served in the Prussian army as an artillery officer. Even then, artillery meant more than just firing a cannon. Ballistics are involved, as well as mathematics and knowledge of physics. Werner's teacher suggests he apply to the Prussian Engineering Corps. There, he would learn the same things that he would at the famous

Bauakademie, but without the expensive tuition. This is what he sets out to do.

WHEN «GO» MEANT GO

The idea of «setting forth» sounds a bit trite, but in Werner's time, it requires a lot more work than today, and is often understood quite literally. A regular connection from Mecklenburg to Berlin — with a stagecoach or a train — doesn't exist. That means Werner must set out on foot in unknown Prussia, which, as a resident of Mecklenburg, is a foreign country to him. Germany as a unified nation does not exist. There is only the «German Confederation,» an association of sovereign states that mutually agree to stay out of each other's way.

At any rate, the political landscape is not Werner's problem. He is more focused on the real landscape — and taking the next step. Even in the military, it is not so easy to simply head off and study. While he does have a letter of recommendation that will get him at least an appointment with the head of the engineering corps, he does not expect there to be a long waiting list of applicants. It isn't a matter of hours or days, either. It may take four or five years before he is able to start at the engineering corps. Four or five years? For such a brimming spirit as Werner's? How is he supposed to even finance the years of waiting?

BOUGHT FREE FROM MECKLENBURG

In this case, «can't» is fitting, and plan B, which sees Werner pursue a career as an artillery officer, is set into motion. According to his memoirs, the head of the engineering corps advises Werner [to try the Artillery, whose cadets attended the same school as the engineers and who had considerably better prospects. I accordingly made up my mind to try my luck in the Artillery.](#)⁹



ARTILLERY AND ENGINEERING SCHOOL Karl Friedrich Schinkel influenced classicism and historicism in Prussia.

Werner makes his way to Magdeburg after all, where he hopes to be accepted by the artillery brigade. Unfortunately, the next obstacle is already waiting for him. Coming from Mecklenburg, he is, as mentioned, a foreigner. To serve in Prussia, he needs to be bought free from his military service in Mecklenburg and receive permission from the king to join the Prussian army. This is successful, and he passes the entrance exam as well, but only after cramming for weeks to fill his biggest educational gaps in French, history, and geography.

Werner is happy. It is a big opportunity for him. In being allowed to join the Prussian army, he sees [the opening of the only path then possible in which my energies could be developed](#), as he writes in his memoirs.¹⁰

ELECTRICAL RESISTANCE

The decision certainly pays off. His education from 1835 to 1838 at the Artillerie- und Ingenieurschule (Artillery and Engineering

School) in Berlin is sound. He is lucky with his teachers, as well: all excellent scientists and mathematicians, including the mathematician Martin Ohm, whose brother, the experimental physicist Georg Simon Ohm, had made a name for himself researching electricity. Georg Simon Ohm is associated with Ohm's law, which refers to the proportionality between current and voltage in an electrical conductor, known as electrical resistance. This physical phenomenon would later play a key role in Werner's life: in transmitting electrical signals over long distances, in the use of electric motors, and in transporting high voltage current over power lines.

THE «SIEMENS UNIT» IS BORN

There was a time when a unit of measurement called the siemens was an option for the international unit of measure for electrical resistance, as Werner was later closely involved in measurements in the new field of electrical engineering. For the technology behind the telegraph, it was crucially important to precisely calculate the ability of a given material to conduct electrical current. In 1860, Werner publishes an essay proposing a universal method that would pinpoint the electrical conductivity of a given material. He worked away at the project until he is able to determine that a column of mercury in a glass tube at zero degrees is the ideal measure. The «siemens unit» is born. It isn't until around 20 years later at the International Electricity Congress in Paris that it is agreed that the reciprocal of the siemens — resistance rather than conductivity — will be used as the standard measure. It is named after Georg Simon Ohm, the discoverer of the phenomenon. If anyone had told that to young Werner, while he toiled away in math lessons conducted by the physicist's brother, he would have likely just stared in disbelief.

CONCERNS ABOUT THE FAMILY

While Werner immerses himself in the new world of engineering in Magdeburg, his parents' lives come to an end. His mother dies in 1839, and his father in 1840. The children are looked after by relatives, who also act as guardians for the underage children. Werner has long seen it as his duty to care for the well-being of the orphaned Siemens family — and for that he needs one thing: money. He earns an income as an artillery specialist, but it isn't enough. Instead, he turns to another resource to bring in more money: his inventiveness. His goal is to invent something that will generate an income. Alongside his desire to enter new territory in engineering and to be a successful scientist, Werner is driven his whole life by one concern that remains with him until the end: the well-being of his family.

COMPANION- IN-ARMS

A close friend and companion through thick and thin: William Meyer becomes Werner's trusted confidante, one he can absolutely rely on at all times.

Engineering school is a formative experience: a time of learning among kindred spirits. It is also the start of the [closest and completest friendship](#).¹¹

In William Meyer, Werner Siemens had found a [real friend](#). They become acquainted at the Horse Artillery in Burg, near Magdeburg. In his memoirs, Siemens' description of his life-long friend is an illustration of his typically frank and prosaic outlook: [He had a far from imposing figure, was in no respect distinguished or talented, but possessed a clear understanding, and pleased me from the first by his straightforward, unaffected nature](#).¹²

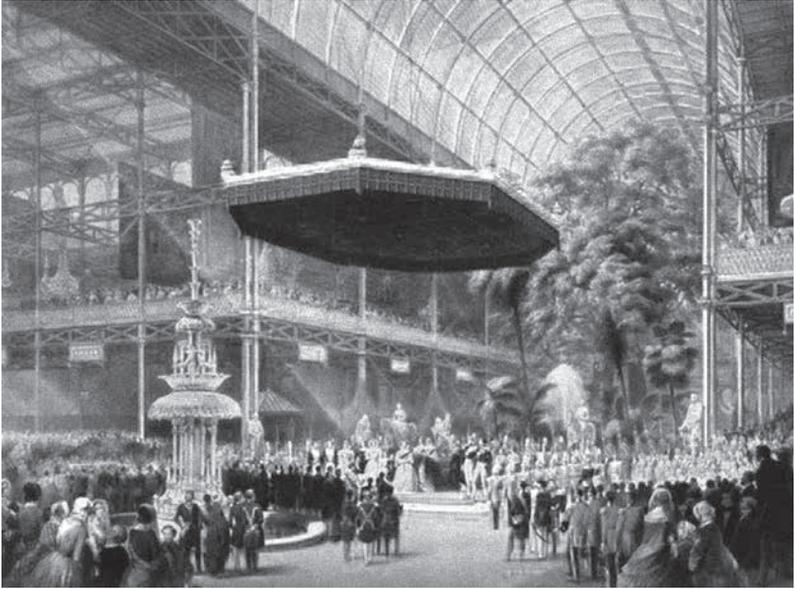
Not especially good-looking, not talented either, but forthright.

After my parents' death, the duty devolved upon me of providing for my younger brothers and sisters, of whom my youngest brother, Otto, was at the time of our mother's death only in his third year. It is true the farming of the domains still remained in the hands of the family for a number of years, but the times continued to be extremely bad for agriculture, so that the slight profits made from farming by my brothers Hans and Ferdinand did not suffice for the education of the children. I was therefore obliged to look out for some way of earning money in order to fulfill my obligations as senior of the family, and that appeared to me to be easier in Berlin than elsewhere.¹⁴

This impresses young Werner, and the two become a team: *We chummed together at the school, lived and studied together, had the same quarters then and thenceforward, whenever circumstances allowed of it.*¹³ When Siemens incites a rebellion against the «tyranny of the officer cadets,» Meyer is his second in a duel with the barrack-room leader. Wherever one is, the other is never far behind. Later, after graduation, Werner returns home for a while — and brings William Meyer with him. The friendship endures, and Meyer is always there: an important person, an advisor, a loyal companion and life-long friend.



THICK AS THIEVES,
circa 1844



THE 1851 WORLD EXHIBITION IN LONDON BECOMES ONE OF THE GREATEST FAIRS OF INDUSTRIALIZATION Werner of course attends.

SUCH TIMES!

The energy is in the air: the decades after 1840 are an explosion of possibilities. Werner is right in the midst of it all as a creator and contributor.

Werner's life takes place during a breathtaking period in Europe. The continent is swept up in two revolutions—the French revolution on the one hand, and the industrial revolution on the other. The impact of both events can still be felt today. Humanity witnesses some of the biggest breakthroughs in its history across politics, technology, and society. Prior to industrialization, work is equated with manpower and skill—mostly in the formative areas

of agriculture and the trades. The arrival of machines changes everything.

It begins with the steam engine by James Watt. Further-developed and mobile versions of the Scottish inventor's machine give momentum to industrialization. The mass advancement of coal and iron ore, along with the construction of railways, pave the way for the industrial boom. In 1830, an economic and social dynamic takes hold in England that will soon reach the European mainland and later North America. Completely new social structures and living conditions are ushered in, and the class-oriented, agricultural society comes to an end. New methods of production are introduced, factories are built, and massive numbers of jobs are created — a breakthrough that could not have been more crucial. Social life is completely changed by the new technology as well.

Today, we are fascinated by the possibilities of the digital world; back then, they are fixed on the new scientific discoveries and the ways they can be used. Just as it is necessary today to make sure the digital transformation doesn't supplant humans, the effects on the rights of workers amid all the passion for technology must also be considered in the 19th century. Werner proves to be a pioneer in both the technological and social side of innovation.

DISRUPTIVE POWER EVERYWHERE YOU LOOK

It's true that we live in a period of radical change: the advent of computers and robots, the digitalization of the world, the internet with its risks and opportunities, and industry 4.0 with self-driving cars and self-controlling factories. Development is very fast. The Apollo 11 onboard computer for the moon landing is laughable compared to the computing power of today's smartphones. There is disruptive power at every turn, and no single person has an

overview of the innovations like nanotechnology that are in use at science and biotech firms.

People in the 19th century must have experienced the revolutionary developments of that time with similar feelings. The lives of Werner, his brothers, and other important contemporaries such as Hermann von Helmholtz span one of the most innovative historical periods of the Western world. The breakthroughs and changes that occur in the short period between 1840 and 1880 — quicker than people could imagine — are enormous.

The leap into modernity is tremendous, the rapid mechanization a profound break.

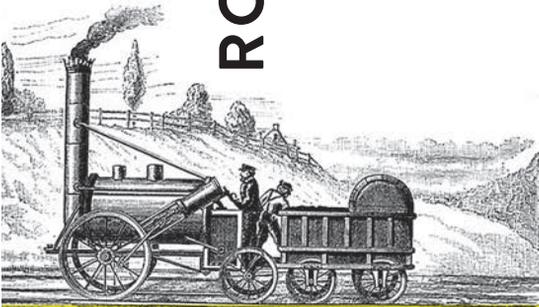
FROM CLOAK AND DAGGER INTO MODERNITY

Werner is part of a transitional generation: when he is four years old, Napoleon Bonaparte dies at St. Helena. It is 1821 when Napoleon's reign ends — a very long time ago when viewed from

THE ROCKET

*The age of acceleration:
By the end of the 19th
century, locomotives
had a top speed of more
than 200 kilometers per
hour.*

In 1829, when Werner is 12 years old, a self-taught engineer from the north of England called George Stephenson wins the Rainhill Trials with his innovative steam locomotive, «The Rocket.» This competition is held to decide which engine was to power the world's first regular passenger train service, between Liverpool and Manchester. It still wasn't clear whether this technology would work at all, or whether it might not be better to install a stationary steam engine every few kilometers to haul the wagons along the tracks. Stephenson's engine was reasonably reliable and well-suited



today's perspective. Musketeer films come to mind perhaps, a lifestyle from the distant past. Around 50 years after Napoleon's death — a relatively short period in historical terms — and less than a year after the Siemens brothers' transatlantic telegraph cable begins operation, Konrad Adenauer, the first chancellor of what would later become the Federal Republic of Germany, is born. The year 1874 saw the birth of Winston Churchill, who would go on to become the British prime minister. Both statesmen — historical figures in their own rights — are connected to our modern reality. Seen and heard on audio and video recordings, we are familiar with their «modern» appearance. The modern era was already upon us.

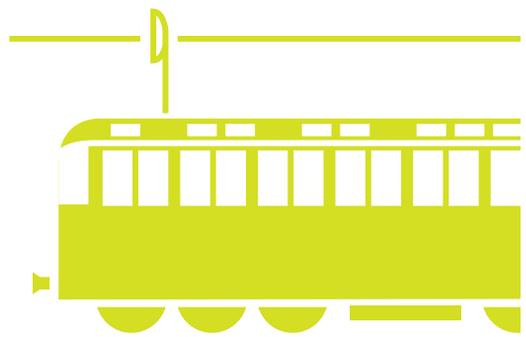
THE GREAT MINDS OF THE TIME

Gustav Freytag is born the same year as Werner Siemens, and both men live lives of nearly the same length. Werner died on December 6, 1892, in Berlin, Gustav Freytag on April 30, 1895, in Wiesbaden. Freytag's multi-volume novels «Debit and Credit»

to everyday use; it could haul five times its own weight and cover 14 to 20 English miles per hour.

Just a few decades later, at the end of the century, the engineers at Siemens & Halske and AEG developed a locomotive that could travel faster than 200 kilometers per hour — an astonishing speed at the time, reached on a test track on the outskirts of Berlin in 1903. Just 30 years earlier, no one had really known what to do with the «dynamo machine» made by Herr Siemens in Berlin. Electric power stations had yet to produce alternating current. It was as if humanity had been

woken from a deep slumber — and one of the loudest voices calling to it was that of Werner Siemens.



(«Soll und Haben») and «Die Ahnen» set the tone for the educated middle-class in the mid-19th century. For decades after, his literary soundscapes are common confirmation or high school graduation gifts. Until 1910, Freytag was the most-read prose author. With «Debit and Credit» in particular, published in 1855, he managed to put his finger on the pulse of the age. It was about rapid personal ascent and quick deals — which, today we would call «financial speculation» — and the effect they had on people. Werner Siemens also identifies with the subject from a business perspective: He strives to be productive and to create something, to build and operate things that improve the world. His word for it is «Fabrikantsein» (being a factory owner). He was suspicious of «fast cash» that beckoned from lucrative investment opportunities.

MARX, SIEMENS, AND VERNE

Karl Marx is born two years after Werner Siemens. The philosopher, economist, and journalist is famous for his criticism of workers' social conditions at the beginnings of capitalism. The question of workers' conditions is one that Werner will also address, especially regarding the workers in his own facilities. While Marx, who lives in exile in Britain from the middle of the century, focuses on overcoming the existing societal norms through a great revolution by the «workers of the world,» Siemens the engineer takes a more pragmatic approach to the social question. He seeks concrete improvements for his workers that are quick and long-lasting.

In 1821, the Russian writer Fyodor Dostoyevsky is born. His great novels such as «The Idiot,» «Demons,» and «The Brothers Karamazov» also address the political and social conditions of his country, which finds itself in a fundamental period of change as well. They deal with conflicts that suddenly exist for people with the rapid onset of the modern era. The publication of Jules

Verne's utopian novel «20,000 Leagues Under the Sea» in 1869 is also a testimonial to the times and the accelerated technical progress. The submarine, which Verne anticipates as a technical development, is powered — unsurprisingly — by the wonder of electricity.

PHYSICS, CHEMISTRY, AND DARWINISM

Charles Darwin's groundbreaking research on the origin of species is published in 1859 — «Darwinism» has arrived. The year 1865 sees the foundation of the Baden Aniline and Soda Factory in Ludwigshafen — BASF — and AEG follows in 1883 in Berlin.

Alexander Graham Bell perfects the telephone as a functional system in 1876, and the university professor Carl Linde invents the technology behind the refrigerator (the ammonia-based refrigeration machine). Nicolaus Otto develops the four-stroke engine, later known as the «Otto motor.» Eight years later, he manages to construct an electric ignition that enables the use of liquid fuel such as gasoline. Konrad Duden publishes his orthographic dictionary of the German language in 1880, and the storied history of Germany's famous Duden lexicon begins. Finally, 1885 sees a certain Gottlieb Daimler take the world's first motorcycle for a spin.



KINDRED BRIMMING SPIRITS Founding members of the Physikalische Gesellschaft (Physical Society), with Emil Du Bois-Reymond seated in the middle, 1845

THE NERDS CLUB

Young minds are changing the world, but physics is still considered a bizarre science. For the nerds of the 19th century, however, it isn't about the image.

For a long time, physics leads an exotic existence, considered as a sort of «experimental philosophy.» It is even ridiculed by the later chancellor of the German Reich, Otto von Bismarck, as a sporting competition for crazy ideas. At this time, there is only applied science, which is synonymous with the experience and knowledge found in simple chemical or weapons technology. Basic, systematic research is still a long way away. However, revolutionary discoveries are sometimes hiding behind the most bizarre phenomena.

Like the computer nerds of the 20th century, the «young guns» of the new miracle of electricity are ahead of their time. Werner and his peers are treated just like the digital avant-garde of the 1960s and 70s who were already picturing personal computers for everyone, at a time when computers filled an entire room, and when science considered digitalization to mean, at best, better data centers. The increasingly modern «physicists» of the 19th century are initially met with everything from skepticism to condescension.

MAGNUS AND THE «NEW AND INTERESTING» TIME

For the nerds of the 19th century, physics is the discipline with which they want to understand and make use of the hidden mechanisms of the world. In that regard, they are successful. Heinrich Gustav Magnus, born in Berlin in 1802, plays an important role. His father was a wealthy merchant and banker. Conveniently, his two older brothers follow in the footsteps of their father, giving Gustav the opportunity to pursue his passion for science. He studies chemistry and physics in Berlin before moving to Stockholm and working in the lab of the Academy of Sciences. Later, he attends the Sorbonne in Paris. In 1831, he returns to Berlin and receives permission to teach at the university, where, in 1845, he is promoted from an extraordinary professor teaching in fringe subjects to a full professor of physics and technology. Prior to that, Magnus also teaches at the Artillery and Engineering School of the Prussian army.

One of his students there is the young lieutenant Werner Siemens. In his memoirs, Werner recalls the happy times at the school and the stimulating lessons from the young professor: *The three years which, from the autumn of 1835 to the summer of 1838, I spent at the Berlin Artillery and Engineering School I reckon to be the happiest of my life. The social life with young people of the same age and with the same aims, the common study under the guidance of able teachers, of whom I will mention only the mathematician Ohm, the physicist Magnus, and the chemist Erdmann, and whose instruction opened to me a world new and full of interest, made this time one of extraordinary enjoyment.*¹⁵

THE PROFESSOR'S HOUSE

Professor Magnus is aware of the importance of communication and the exchange of ideas. He hopes to create a network for kindred spirits that brings together students, young professors, working technicians, and physics aficionados. Not only does he organize roundtable discussions, seminars, and other courses, but in 1840, he also builds a lab in his house for collective experimentation and discourse. A civic «lounge» for physics. It is the time when physical experiments begin to take hold as the best tool for acquiring scientific knowledge.

The «physicists' lounge» is a hit: a professor with whom the students could conduct their own experiments! This is a one-of-a-kind set-up, unheard of at universities where all academic work is still written in Latin. His house on Kupfergraben in Berlin, known today as the Magnus House, opposite the Pergamon Museum, is not merely a meeting point for the clever minds of the city. It also forms the foundation of one of the most important expert associations of the 19th century.

Young talent, inventors, nerds, and engineers come and go from Magnus' house. Key researchers such as Emil Du Bois-Reymond or Rudolf Virchow are among the group beginning to move modern science forward. In January 1845, some of the members start the «Physikalische Gesellschaft zu Berlin» (Berlin Physical Society), which later, in January 1899, becomes the «Deutsche Physikalische Gesellschaft» (DPG, German Physical Society).



PROFESSOR MAGNUS
Networker, communicator, motivator



PROFESSOR HELMHOLTZ
Renaissance man, scientist, resonance expert

IT WAS THE OVERTONES!

Hermann von Helmholtz, born in 1821 in Potsdam, is not just one of Werner's contemporaries. He also becomes one of his closest friends and companions. Helmholtz's daughter, Ellen, even goes on to marry Arnold Siemens, Werner's oldest son. Helmholtz, whom Werner considers to be the **greatest math and physics mind of the century**,¹⁶ is seen as one of the last universal scholars period. He is a medical doctor, physiologist, physicist, musicologist, scientific manager, and scientific politician. In 1870, Helmholtz is appointed to the Royal Prussian Academy of Sciences and the Royal Swedish Academy of Music. He is already a member of the

Swedish Royal Academy of Sciences, as well as the American Academy of Arts and Sciences. In 1883, he is given a title of nobility by the German Emperor, and, since then, is known as «von Helmholtz» — another parallel to his friend Werner.

Even in his youth, Helmholtz appears to have great interest in physics. As a bright boy of his time, he suspects that the observation of nature and the resulting scientific derivations will change the world. Helmholtz probably has a very similar attitude toward life and take on the world as Werner, who will later become his friend. Neither are satisfied with the humanistic curriculum of secondary school.

After finishing school, young Helmholtz first undertakes a study of medicine in the military: He completes surgeon's training at the «Medicinisch-chirurgisches Friedrich-Wilhelm-Institut» (Friedrich-Wilhelm Surgical Medicine Institute) in his hometown Berlin.

THE STRADIVARIUS SECRET

After an early discharge from military service, Helmholtz does not end up becoming a doctor, turning instead to science. He teaches anatomy, receives offers to instruct at university, and dedicates himself to the natural sciences. He soon takes up the subject of color vision and helps achieve a breakthrough by proving that three primary colors — red, green, and blue — form the basis of all other colors. Shortly after, he develops a mathematical theory to explain timbre using so-called overtones. This explains to the world why a Stradivarius sounds better than other violins: it's the overtones!

But the Renaissance man cannot let go of the subject of physics. When Heinrich Gustav Magnus dies in 1870, Helmholtz is named as his successor and Professor of Physics at the Friedrich Wilhelm

University in Berlin. He moves back to Berlin from Heidelberg, where he had been teaching. By this point he is already a celebrity in the scientific community, having made groundbreaking discoveries in electrochemistry, physiology, and many other related disciplines — a pioneer of interdisciplinary research.



PHYSICO-TECHNICAL IMPERIAL INSTITUTE, TODAY THE NATIONAL METROLOGY INSTITUTE OF GERMANY Still considered one of the most important scientific and engineering institutes in the world

Together with Werner Siemens, he creates an institute for metrology called the «Physikalisch-Technische Reichsanstalt» (Physico-technical Imperial Institute) — the first major publicly-funded, non-university research center in Germany, which connects fundamental research with services for the evolving technology-driven industry of the time. There is a lack of recognized methods and standards, and the precision measuring requirements of industrial manufacturing are constantly on the rise. Germany’s current National Metrology Institute, the «Physikalisch-Technische Bundesanstalt (PTB)», derives from the former imperial institute. When it comes to all questions regarding proper measurement, the PTB is considered one of the most important authorities, along with similar institutions in the US and the UK.



BERLIN ELEVATED RAILWAY PROJECT, 1883 Intersection of Leipzigerstrasse and Friedrichstrasse overlooking Potsdamer Platz

PRUSSIA'S E-MOBILITY

The magical substance of electricity — and how Werner unveils a sensation in Berlin: the electric railway.

Electricity is the discovery of those years. The tinkerers, scientists, nerds, and visionaries are fascinated by this wonderful matter and how it can be used. After Michael Faraday publishes his results to the still modest scientific community, the desire to make something out of it is immediate. The desire to produce lots of electricity, or even better: to convert electrical energy into mechanical energy, i.e. movement. To create a type of steam engine, that could fire pistons or carry loads using electricity. What an idea!

Faraday had discovered that a magnet inserted into a wire coil emitted electricity. The same thing happens when the magnet is removed. If this movement is done in quick succession, it generates electrical impulses. But this is far from a permanent flow of current and further still from a machine that can generate electricity. Additionally, it requires a so-called permanent magnet and expensive batteries — which provide the initial, external current — to start the electromagnetic reaction.

As is often the case, this sends many inventors off on the same track at the same time. In 1851, the Hungarian inventor Ányos Jedlik discovers the dynamo-electric principle and generates current with a type of electric machine, but he doesn't seem to recognize the importance of his coincidental discovery. In 1854, Søren Hjørth of Denmark achieves the same result. While he is clever enough to immediately patent the idea behind the machine in England, he never finds a way to develop his device further, let alone make it marketable.

RESIDUAL MAGNETISM

It is Werner's brimming spirit that leads him to tackle the subject anew and make a very decisive discovery. He notices that magnets made from soft iron, which had already been used as electromagnets, always retain a residual magnetism that is sufficient to build up

electrical voltage. If the voltage is passed back to the magnets, the magnetic field and the voltage grow, until the soft iron magnet is fully-charged. Werner calls it «electric self-induction.» He is able to construct a machine that does not require batteries and permanent magnets. The dynamo machine is born. The year is 1866 and Werner, always the former officer, is actually tinkering with technical innovations for the military using electricity. Prussia had recently defeated archrivals Austria in a brief war and is preparing to finally emerge as the leading nation of the German states.

The scope of his invention is immediately clear to Werner, and it must have been a euphoric moment. On December 4, 1866, he writes in the now-famous letter to his brother William: **I have had a new idea that will, in all likelihood, succeed and give significant results. [...] The effects will be colossal, given the right construction.**¹⁷

THE NETWORK HELPS IN THE RACE

Just a few weeks later, Werner presents his invention to the members of the Physical Society. By January 1867, the grandfather of experimental physics in Germany, Heinrich Gustav Magnus,

ELECTRICITY FLOWS

Michael Faraday was another influential scientist of his day.



Another man was to have a formative influence on Werner and his brothers. His impact was such that they even named the ship designed by William Siemens – the first dedicated cable-laying ship – after him: *Faraday*. This was a respectful nod to the natural scientist, who died in 1867 and was a long-standing friend of William Siemens.

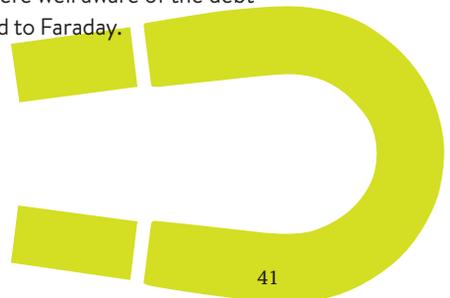
In 1822, this Michael Faraday, an English natural scientist, chemist and experimental physicist, writes in his notebook: «Convert magnetism into

reports on Werner's discovery at the Royal Prussian Academy of Sciences. Werner's connections in the world of established science prove their worth. He realizes that especially in England, well-known researchers like Charles Wheatstone are also on the right track. Werner is lucky: William manages to successfully register the patent for the dynamo in England.

It is the beginning of heavy-current engineering. Apart from the unprecedented force that further improvements would bring about, the machine could be used in principle as both a generator and an electric motor. The gates to commercialization are open, and Werner is relentless. Now that it is possible to construct electric motors that are stronger than horses and can compete against steam engines, cities will soon look completely different. Plus, there are the business opportunities that come with the dynamo. Werner writes his brother Carl in March, 1867: [...] on Thursday I'll come with the new transmitter to a large presentation before the academy and finalize the matter. This device will be the bedrock of a great technological revolution which will raise electricity to a higher plane among the elemental forces!¹⁸

electricity.» Magnetism into electricity? Had he announced this openly in 1822, his contemporaries would have considered Faraday — an autodidact — to be a fantasist. Yet a few months earlier, in his laboratory, Faraday had already discovered that not only did electric current create a magnetic field, electricity could be obtained from magnetism, too (electromagnetic induction). Soon afterwards Faraday also demonstrates that mechanical movement can be created by electric current.

Faraday was one of the first to be convinced that electric currents flowed, similarly to water. And he believed in the reciprocal convertibility of magnetism, electricity, light and warmth. Werner and his brother William were well aware of the debt they owed to Faraday.



300 METERS TOWARD ETERNITY

The electric railway is one of Werner's favorite ideas. As early as 1867, shortly after the discovery of the dynamo-electric principle, he becomes a believer in e-mobility and initially plans to develop electric trains for the mining industry. *At that time I was already considering, among other things, electric railways through Berlin to reduce the amount of traffic on the streets. But the dynamo-electric machine was not finished, and its teething problems still needed to be overcome.*¹⁹

That would take a few years, but in 1879, the day has come. At the Berlin Gewerbeausstellung (Berlin Trade Fair), Siemens & Halske unveil a global sensation: an electric train. It is, however, quite inconspicuous. Basically, the small locomotive is just an electric motor on wheels. The train conductor squats on the engine, which pulls three open carriages with wooden benches behind it. Werner built a 300-meter circular track for the train to circle around.

It becomes an absolute hit: everyone loves it, and it is estimated that 90,000 visitors take a spin on the train. The current (150 volts) is produced from a flat, iron band installed between the rails. It flows back over the wheels and the rails. The train makes round

THE ELECTRIC TRAIN SPECTACLE

The train made its rounds at seven kilometers per hour. People in Berlin were fascinated.



after round at a maximum speed of seven kilometers per hour and becomes the highlight of the exhibition. Werner describes the success in a letter to his brother Carl: [Our electric railway here is quite the spectacle. It has gone well beyond expectations. In just a few hours per day, around 1,000 persons pay 20 pennies each for charity, 20 to 25 persons per lap. The speed is about the same as a horse-drawn railway. There is certainly potential here!](#)²⁰

But, as is often the case, the real revolution of what is behind this harmless train, and the fact that it is the beginning of a technological revolution that will completely change transportation over the next century, is lost on just about everyone, probably even the inventor himself. In May 1881, Werner writes his brother William: [I think it is clear that we don't want to compete with the locomotive over long distances. We want to use electric operation where the locomotive is not suitable, and secondly, replace horses with electric enterprise.](#)²¹

Most people don't think that this little train will ever completely replace the «steamer,» which was once the symbol of technological progress, or that the «train without steam or horses» will have a future at all. The assessment of the technical journal «Der Techniker» in 1880 is quite clear: «As a working example of the conversion of mechanical power to electrical power and back to mechanical again, the electric railway was interesting, even if we don't see any broad use at the moment.»²²

The assessment doesn't keep Werner from taking the next step.

MEGA-CITY BERLIN

An electric railway straight through the city would have been the solution, perhaps similar to New York. Werner has not yet been to the New World, but he has heard that they have elevated railways. They were, however, pulled by steam locomotives — smoking trains through the urban canyons. That is not what Werner has in mind. He wants a solution without steam, smoke, and noise. If it is not possible to reduce the amount of traffic, a clean variation should be put to use on the rails instead — an electric elevated railway.

After all, the city has a traffic problem. Berlin is becoming a metropolis and has reached the threshold of a million people. The city is bursting at the seams, a mega-city of the 19th century. *You see how our busier roads are becoming more congested every day with the increase in traffic. It's often hardly possible to get through, and no police constable can do anything about it,* pleads Werner on January 27, 1880, in a speech to the Elektrotechnischer

DESIGN THINKING

Werner von Siemens was one of the first design thinkers: a translator of bold ideas.

Creativity is seen as a key resource in today's world — a prerequisite for innovation. A creative person is capable of imagining something that does not yet exist. Werner Siemens, for example, imagined an elevated electric railway — and searched for a way to make it reality. But where do ideas come from? Constant mental struggle, it would seem. Creative people are said to be versatile but tremendously contradictory personalities. But they tend to adopt a playful approach. Whereas most people ask «Why?», creative people ask «Why not?» — and give it a go.



Verein (Electrical Engineers Association) in Berlin. The businessman is concerned: [What will this be like in ten, 20, or 50 years? The statistics on the increase in traffic give us the right to say with the fullest determination that the roads will no longer be adequate for the near future.](#)

Werner would not be Werner if he was only spouting forth grim prophesy. He also says: [It is therefore necessary for Berlin to create a new network for fast passenger and freight transport that does not hinder traffic and that is not inhibited by traffic.](#)²³

He knows just the solution, too.

AN ELEVATED RAILWAY ON FRIEDRICHSTRASSE

Shortly after his speech in 1880, Werner submits plans for an elevated train line in Berlin. The first main line is to traverse Friedrichstrasse, with the narrow rails built on iron columns. New electric trains would ride on the rails: clean, quiet, and fast. It

Why not have an elevated railway along Friedrichstrasse all the way to Wedding? Ultimately, what distinguishes a creative idea is not its audacity but the fact that, sooner or later, everyone realizes that it is both real and viable. This was also very true of Werner Siemens, who foresaw the electrification of the world when hardly anyone else was even capable of thinking about it. These days, companies use specially developed techniques to spark people's creativity – like «design thinking,» a method that takes a playful, multi-disciplinary, and interdepartmental

approach to solving problems and issues, and developing new ideas. The ideas are put to the test, developed and considered; many are then rejected, only for the process to begin all over again. All participants contribute. The term «design thinking» sounds very modern, but when Werner Siemens used a cigar box to explain the principle of the pointer telegraph to Halske, his future partner, he was taking a very similar approach.

is essentially a project built for Berlin, and a logical development for Werner: [Berlin is the birthplace of the dynamo-electric machine and the electric train](#)—it should therefore be the first in the world to move forward with the installation of an electric elevated train.²⁴

But it won't happen overnight, and for the inventor and entrepreneur who always thinks three steps ahead, the leisurely pace of those in charge gets under his skin. Werner writes to his brother Carl in February 1880: [Berlin has been debating for eight days now our proposal to the magistrate on licensing an electric elevated railway from Weddingplatz through the grand Friedrichstrasse to Hallesche Tor with a terminus at the city rail and the train station at Dorotheenstrasse! It is going to be an uphill battle, but I hope to be victorious. Perhaps it will be necessary to overcome the reluctance of homeowners to approve electric lighting for the middle part of the street. They would have the advantage of setting up cheap lighting for shops and saloons](#)



THE WORLD'S FIRST ELECTRIC STREETCAR IN BERLIN-LICHTERFELDE Werner Siemens created it at his own expense. 2.5 kilometers of e-mobility.

by attaching conductors to the railway girders, which could provide power or light everywhere. That's the only way to make electric lighting more generally available, and, at the end of the day, it would even be advantageous for us to light the streets for free.²⁵

These few lines say it all: Werner sees the new world and has the future in mind. From today's perspective, it could be said he hit the nail on the head. But in 1880, the electric elevated train just didn't work out. It fails due to the protests of land and home owners. They believe Werner's plan will lower the value of their real estate. A rail line through the middle of the city – no one will want to live there, it will only drive the prices down! On May 12, 1880, Werner writes to his brother William: *The homeowner's agitation has become quite fierce, and the Kaiser has already indirectly sided with the homeowners on Friedrichstrasse!*²⁶

The keepers of the peace prevail, at least on Friedrichstrasse. And to be honest, the street really was a little tight for an elevated railway. Instead, a few years later, the street got a lovely underground electrical railway.

THE FIRST TRAM

That is not the end of Werner's e-mobility designs. One year later, at his own expense, he builds a 2.5-kilometers street car line in Berlin—the world's first electric tram. It plays a role in shaping cities as we know and use them today. In addition, now that the generator and the electric motor have been invented, setting heavy things in motion or lighting up bulbs are not the only things that can be done with electricity. Soon, it will be possible to use electricity to backlight pictures, brilliantly bright, making way for the birth of cinema in the 20th century. The microphone comes later, and eventually, the electric guitar, which can be turned up as loud as desired.



YOUNG GUNS Johann Georg Halske and
Werner Siemens understand each other implicitly.
A duo that causes quite a stir.

WERNER FINDS AND LOSES A COMPANION

*Twice the spirit. Johann Georg Halske is the man with whom
Werner will turn the world upside down. But the end of their
partnership comes sooner than expected.*

The electric tram, the dynamo machine, illuminating the city — that all came later. In the 1840s, Werner — the great inventor with huge ambition — is looking for just one thing: a partner with whom he can implement his vision of fast and reliable telegraph communication. As well as having a few good inventions up his sleeve, Werner is an active member of the Prussian army with good ties to potential customers. That is when Johann Georg Halske enters Werner's life, a man who is well-connected to Berlin's scientific hot spots. Their introduction comes thanks to another young gun of the new sciences, who, in 1845, co-founded the Physical Society: Emil Heinrich Du Bois-Reymond.

It is New Year's Eve, 1846. Werner is gushing about his ideas. Halske, the precision mechanic, is skeptical, but that just shows he does not yet know Werner. He doesn't merely talk about the impact of his improved pointer telegraph — Werner demonstrates it on the spot. Using an improvised setup of cigar boxes, tin plate, some pieces of iron, and a bit of isolated copper wire, Werner creates a working telegraph. Halske is impressed. [This unexpected result filled Halske with so much enthusiasm — for a design capable of success notwithstanding such defective materials — that he gave himself up with the greatest eagerness to the construction of the first apparatus](#), Werner writes in his memoirs.²⁷ Halske rebuilds the prototype in his workshop and devotes some thought to how it could be marketed. Now convinced, Halske is ready to become, with Werner, one of the most successful duos in economic history.

THE WIRE THAT WRITES HISTORY

The device is based on a manually-adjustable pointer whose position is sent to the receiver. The receiver's pointer is then placed in the same position. Individual letters of a text can therefore be transmitted without having to write them in Morse code.

My telegraph uses only one wire, can be played with keys like a piano and connects, with the utmost certainty, at such a speed that you can telegraph almost as fast as the keys can be pressed. It is ridiculously simple and quite independent of the strength of the current, provided it is strong enough to lift the rotor. This can, however, be already be achieved by an exceedingly weak current by means of a new, already proven construction of the magnets.²⁸

By 1847, Johann Georg Halske had parted ways with his existing business partner, and on October 1, 1847, he and Werner found the «Telegraphen Bau-Anstalt von Siemens & Halske» (Siemens & Halske Telegraph Construction Company). Shortly before, in August 1847, Werner writes to his brother William: *At the moment, this is how things are looking: I have definitively agreed to build a workshop with Halske, the mechanic who recently separated from his associate, and it will hopefully be fully operational in six weeks. [...] Halske, who is an equal partner in the factory, will manage it, while I will manage the lines, contracts, etc. For now, we only want to make telegraphs, signal bells for railways, and gutta-percha isolated cables. [...] Such a facility is completely lacking so far, leaving us without competition, and well-protected with my patent and my already considerable influence.*²⁹

THE MECHANICAL ARTIST

The young company celebrates its first success when it lays telegraph lines in Germany. However, when the «Telegraphenkommission» (Telegraph Commission) withdraws its contract in 1851, the duo looks increasingly — on Werner's lead — for contracts abroad, especially in Russia. Werner takes over this area of business, while Halske remains in Berlin where he holds the position of workshop leader and labor organizer. With the expansion, the company shifts its focus from handicraft to industry — a development that Halske,

who understands himself as a «mechanical artist,» only agrees to with reluctance.

A cable-laying project in 1864 between Cartagena and Oran that ends in a financial, material and public disaster, encourages Halske to pull out of the company, a decision he had already made a year earlier. He is overwhelmed by such entrepreneurial adventures.

But how does it come to this parting of ways?

DEEP IN THE RED

Werner believes that telegraph lines will soon be in every corner of the world, that seas and continents will be bridged, and that everyone will be able to contact one another using the new technology. For the middle of the 19th century, it is a great vision, but at first it falls through.

While Werner enthusiastically envisions his global enterprise and continues to outpace the competition in England and America, in 1864, the Siemens company is overshadowed by a crisis. It wasn't the first.

Werner and his brothers are convinced from an early stage that telegraph connections can be laid over previously unimaginable routes. They should even be fully functional under water and over thousands of kilometers — in the middle of the Atlantic! That means the delicate cables need to be well-insulated. But unfortunately, the best material — plastic — hasn't yet been invented. Insulation had already proven to be a serious problem for the overland lines, and salt water would present new challenges. Every fisherman's net or dragging anchor posed a destructive danger to a telegraph connection. No wonder Johann Georg Halske, Werner's long-time



A SEA CABLE FROM SPAIN TO ALGERIA A huge plan that fails, but still marked the beginning of cross-continental communication.

business partner, is hesitant. He is wary, above all, of the financial risk: £15,000.

But the Siemens brothers are convinced. William, in particular, sees an appealing technical challenge and a profitable market opportunity in the laying of sea cables, for which he is prepared to take the risk. The brothers even open a cable factory in London to make themselves independent of sloppy suppliers. Rather than buying cable, they make their own. This is more expensive, but is soon seen as more reliable and secure. Finally, the long-awaited order from the French government arrives: a sea cable to connect Spain with the French colony of Algeria. It still isn't quite the dream connection between America and Europe, but a cable across the Mediterranean is a prestigious start and the opportunity to press on with global networking. The realization of Werner's vision, at least in theory.

MISSING THE BOAT

In practice, the brothers fail spectacularly. The cable breaks and can't be found, the ship is damaged, and in a single day, the Siemens brothers lose their entire investment: £15,000 gone, just like that. It is half of their business capital. The London branch is suddenly with its back against the wall, especially since it must lay a second line as a replacement for the lost one. For Halske, enough is enough. He feels vindicated and withdraws himself from the company. His passion is in the precision work on individual pieces — not with industrial production, nor the internationalization of the business. For Werner, however, this is precisely the entrepreneurial appeal and an important step toward implementing his vision of global connectivity. At that moment, however, the Algeria sea cable failure is a hard blow. Instead of creating a connected world «Made by Siemens,» the London branch finds itself deep in red in its annual report.

The first years of the family business are not short of crises, but the Siemens brothers don't give up. The vision is intact and their will undeterred. Werner and his brother William, who founded the company's own cable factory in the expanding English market, know their technology is outstanding — and setbacks are part of the process. Much later, when the transatlantic cable had been laid in September 1875, is Werner finally able to write his brother Carl: *So, finally, the arduous work was a success and the cable has been finished without a fault! Thank God this nightmare is over.*³⁰



THE FIRST CRISES

A broken cable isn't the first setback. Werner learns that customers aren't always willing to comply. Occasionally, they even have the upper hand, which sometimes carries consequences.

The first severe crisis for Siemens & Halske comes in the form of a Prussian official. Friedrich Wilhelm Nottebohm is a government and building council official and head of the telegraph administration. In 1851, Nottebohm makes life difficult for Werner, as he undertakes a risky task and dares to confront the administration. In response, the Prussian telegraph administration makes it very clear who is in charge.

Werner learns that good contact with contractors in government offices can also be detrimental — at least if you're a self-confident entrepreneur who is forced to acknowledge technical problems.

In 1851, Nottebohm believes a line has to be drawn — immediately. He has his reasons. The 500-kilometer cable system between Frankfurt am Main and Berlin, an early and important project for Siemens & Halske, keeps breaking down. There are massive disruptions in operation. Eavesdropping occurs, and incorrect texts are being transmitted — on more than one occasion. The problems are increasing, and the new cable — partly above ground, partly under — proves to be unreliable. Nottebohm blames Siemens & Halske for what he considers to be shoddy

work by the company. The pair counter by saying a tight deadline, which forces the work to be rushed, is to blame. They believe responsibility lays with the Prussian administration, indirectly pointing the finger at Nottebohm.

Nottebohm reacts promptly. He withdraws orders from Siemens & Halske for further lines, blocks patent applications for years, and makes special designs, developed by Siemens & Halske, available to other suppliers — with best regards from the administration. Werner is beyond peeved. He'd usually gotten along well with Nottebohm, at least until 1851.

NEXT GENERATION SCIENCE

In 1848, everything still looked rosy. A few months earlier, Werner, who was still serving in the Prussian army, and the precision engineer Johann Georg Halske, establish the Telegraph Construction Company. Together, they want to market the pointer telegraph and include refinements made by Werner. It is all about new technologies and unknown methods — applied science of the next generation.

The plan works, and the two are awarded a contract from the Prussian state. They are tasked with the delivery of equipment for Europe's first real cross-country connection between Berlin and Frankfurt am Main, in addition to further lines across Prussia. They are also in charge of supervising the cable-laying effort. The order comes at exactly the right time. The first German parliament is due to meet in Frankfurt, and the value of fast news isn't to be underestimated.

BREAKING NEWS IN ALMOST REAL TIME

Werner copes with the mammoth project. *I've been called back to lay the telegraph lines to Frankfurt am Main and Cologne. Since both lines need to be finished by this winter, I naturally have a lot to do. [...] My telegraphic system with underground cables has now been adopted by the state and is recognized in the private sector as the best. This will help me progress!* Werner writes to his future father-in-law Wilhelm Drumann in August 1848.³¹

A few months later, the line has been laid and one thing is clear: the new communication channel works. On March 28, 1849, the following «breaking news» is sent via the new line: The Prussian King Friedrich Wilhelm IV has been elected by the German National Assembly as the German Kaiser. The sensational news is transmitted almost in real time, which, back then, was approximately within the hour.

GOLF BALLS, OF ALL THINGS!

Golfers in the mid-19th century had cause for celebration. As to whether it's really true that Reverend James Patterson from Dundee in Scotland was the one to discover gutta-percha, nobody knows for sure.



Patterson is said to have discovered «gutta percha» – the condensed plant sap of a broad-leaved tropical tree – during his time as a missionary in Malaysia. We also, allegedly, have him to thank for its use in the production of golf balls, replacing leather ones that had to be laboriously stuffed. The properties of the milk from the gutta-percha tree were ideal: It hardened at room temperature and became malleable again at a temperature of 50 degrees Celsius. The name comes from the Malaysian, deriving from «getah» for rubber and «percha» for tree. This deciduous tree with its special milk is found only in south-east Asia. Gutta-percha is like rubber, but much harder.

In comparison, the official envoys of the National Assembly don't meet in Berlin until a week later.

WERNER ON TRACK

I had the satisfaction of seeing the first long telegraph line — first not merely in Germany but in Europe — already at work in the winter of 1849, so that the election of the Emperor, which took place in Frankfurt, was by its help known at the same hour in Berlin, Werner writes in his memoirs.³²

WERNER PUBLICLY DEFENDS HIMSELF

This is the start. Werner left the military service and gave up his claim to a pension. He wants to finally be a free man and to realize his entrepreneurial vision. Networking the world can begin — if it were not for the difficulties, the little things, which

In London, the heart of the British colonial empire, this material was soon being passed around as an object of fascination. The industrious William Siemens is among those to get his hands on some and immediately sends a sample to his elder brother Werner in Berlin. It was sure to be good for making something — and so indeed it did. It quickly became apparent that this novel material was extremely durable, and that it did not conduct electricity. This makes it an obvious choice for the insulating material they had sought for so long. The only question is: How could it be laid around a copper cable? And how could they prevent water or soil from getting inside the casing afterwards? Werner

finds a solution and had it patented, a milestone in the history of telegraphy. A seamless coating of gutta-percha ensured that there was no more interference on the line. Above all, Werner has taken a giant step closer to realizing the dream he shared with his contemporaries: a telegraph connection that crossed the seas, and might one day reach across the Atlantic. This connection was made faster than the gentlemen in their London clubs could ever have dreamed when they held the new material in their hands for the first time.

sometimes cause great ventures to fail. Until then, telegraph cables were usually laid in the loose sand of railway embankments. But they are often damaged by mice, rats and moles — not to mention country railway workers, who aren't aware that minor damage interrupts the flow of data.

Despite the deadline pressure, Werner decides to bury the cables about one meter underground with a foam coating. Although the measure is supported by the Prussian administration, Nottebohm later blames it for the project's failure.

Siemens & Halske are denounced for the foam coating — and Werner defends himself. Publicly. He publishes his defense and thereby exposes the authorities, which is not received well by Nottebohm. But Werner and his companion Halske are attentive workers and conscious of their product's quality. They go to the trouble to dig deep and find the cause of the problem. They learn it was not a good idea to vulcanize gutta-percha by mixing it with sulfur. It turns out that the foam coating reacts with the copper cable, creating copper sulfate within the cable and huge disturbances on the line.

Werner also discovers that the cable charges itself electrostatically, a new, little-known phenomenon which prevents power surges from being sent quickly through the cable one after the other. Nothing special, but the electric signals are intercepted from the telegraph. Werner solves the problem. It is clear to him that even longer connections won't work at all under water. Nottebohm, meanwhile, takes no notice of this trouble-shooting, or of their diligence.



CARL SIEMENS, circa 1875

CARL FINDS THE CABLE

Yet another crisis for a brother to solve, and how Werner and William skillfully put their own invention to use.

The vessel is an impressive sight and sets new standards. It is a cable-laying ship called *Faraday*: 110 meters long, 16 meters wide with a second propeller for added power and an additional rudder for increased maneuverability. Every last ounce of energy and know-how that the brothers possess is poured into its construction. Launched in Newcastle in northern England in 1874, it is the pride of the Siemens family. The *Faraday's* task is to lay transatlantic telegraph cables all the way to America. Technological advances make it possible to insulate copper cables safely so they can be quickly and efficiently laid deep under water by a ship like *Faraday*. With its three huge cable drums, it is to sail 3,000 kilometers from

the Irish coast to Newfoundland. A major technological undertaking, observed throughout the world.

STRUCK AN ICEBERG?

On board the *Faraday* are Werner's brother Carl, as well as Ludwig Löffler, a mechanic who has worked for William Siemens since 1858 and who keeps a close eye on Carl. The first few days go well. Sometimes, having released too much cable into the water, it becomes twisted, but the project runs smoothly for the most part. Werner himself isn't there but follows the operation from afar.

After a few days, worrying rumors begin to circulate. Rumors that *Faraday* had been involved in an accident, that it had struck an iceberg, even that they had lost the cable. It looks as though



ON BOARD FARADAY Loaded with huge cable drums, the massive ship sets sail. Destination: Newfoundland.

a catastrophe is unfolding. On the stock exchange, shares in the Direct United States Cable Company, the company founded by Carl Siemens for Siemens Brothers, begin to crash. Messages race back and forth, urgent yet contradictory reports. Nobody can say for sure what is going on and the rumor mill continues to turn. Between London and Berlin, the telegraph lines are glowing.



ONE BROTHER IN LONDON
William Siemens, circa 1880



THE OTHER WAITING IN BERLIN
Werner Siemens, circa 1870

Faraday struck iceberg south of Halifax. No further news. Please come. William.

Setting off tomorrow midday. Messages arrived here this morning, tomorrow evening Verviers station restaurant. Werner.

No confirmation and doubt whether Reuters New York message trustworthy. Please still come. Ambassador dispatched. William.

All telegrams from America and Halifax completely contradict Reuters telegram on sinking of *Faraday*. Siemens.³³

ONLINE BANKING IN THE 19TH CENTURY

Fast communication links are a good thing. A pity they're not very confidential. It was the same back then with telegraphy as it is with the internet today.



The cable did tear, and at a depth of 5,000 meters, of all places. But Carl — who doesn't always have it easy with his brothers and who is immediately blamed for the loss of the cable — manages to save the day with an ingenious recovery operation. An anchor is lowered — which itself takes seven hours — and is drawn through the water to pick up the cable. It is an enormously time-consuming search that sees the cable lost a few times and torn in several places. But finally, what seemed impossible is finally achieved, and the cable is recovered.

Werner's vision is for people in India to be able to read news that has been typed in Prussia only hours before. He plans to lay cables across the Mediterranean so that messages from Europe can reach North Africa — Egypt and Algeria — too. Global communication is his dream. But Werner is also aware of its weaknesses. Even he doesn't yet fully trust this great invention.

In March 1859, when he is traveling in Egypt, he writes to his wife Mathilde: *I imagine I will have to wait a very long time for a letter from you. [...] In order that we should at least receive news of each other, let us do as follows. Every time you write, write two letters: a private one with a special seal, and a second, short one summarizing the most important points, unsealed. I will arrange for all letters to be sent to Suez, where they will be opened by our officials and the contents communicated to us by telegraph. If necessary, I can then send a reply in the same way from on board the ship. Discuss this plan with Halske or Carl.*

Werner writes in September, 1874: [The recovery and repair of a cable from such a depth \(2,580 fathoms\) in a single day is a first in cable-laying technology and will further establish our reputation—assuming we are successful.](#)³⁵

And that is just what transpires: the Siemens cable goes into operation on September 15, 1875, beating all challengers in a telegram transmission race that is put on by stock brokers. The Siemens brothers are a whole hour quicker than the rest.

[The best thing would be for Carl to compile a list of important business, family and private news in condensed form and send this letter to Alexandria. All private messages that are not to be telegraphed must be sent with a special seal.](#)³⁴

Sealed. Private. Not for the eyes of others. He doesn't want other people reading his wife's words. That's the way it is: As long as people have been inventing things, others have been trying to figure out how they can misuse them. Telegraphy was no exception. Messages in Morse code were deemed less secure than letters. There was considerable potential for «data leaks» in the sending, receiving and transcribing of messages. Telegraph operators were seen as «incorruptible,» but as many as six people were involved in the transmission of news: the one who records and sends the message, the one who receives the text and notes it down, and the messengers who take the telegram to the client. This was not a high-security solution. The postal service was still safer.

The post office didn't have to read the letters it distributed. With telegraphy, this was unavoidable; it was part of the service. Messages passed through numerous hands, which meant messages were sometimes intercepted and fell into the wrong hands. A tricky business, especially as there was already something akin to «online banking.» In 1877 in the United States, almost 2.5 million dollars were sent by «telegraphic transfer.» This new network was also used—and abused—for share transactions. The science journalist Tom Standage tells of a banker in the 1850s who bribed a telegraph operator to leave certain misspellings in texts, which communicated a coded message about trends on the stock exchange. And «eavesdropping» happened back then, too: Some countries forced telegraph companies to retain message histories so that these could be read by the police if necessary.



TELEPHONE LINES IN THE CITIES Networks are created, like here in Kassel, 1891

BETTER THAN BELL

The telephone is invented, but unfortunately not by Siemens. However, Werner knows how he can use it to turn a profit. Berlin becomes the first Silicon Valley in history.

Suddenly, a man named Alexander Graham Bell appears on Werner's patch. Like Werner, the deaf-and-mute tutor from Canada is interested in telegraphy and has been experimenting with «multiplex telegraphy» — the simultaneous transmission of multiple pieces of information. Most of all, Bell wants to move beyond Morse code and transmit speech. To achieve this, he recognizes that a change in the flow of electricity is needed rather than the constant interruptions. Bell also bases his work on

electromagnetic induction, researching and researching until finally filing a patent application for a telephone on February 14, 1876. Although his telephone isn't fully developed, the patent is awarded three weeks later — cutting out all competition. He starts the Bell Telephone Company in 1877, which takes on the task of constructing a telephone network in the United States.

In the same year, a man in the Charlottenburg district of Berlin also makes a decision. [Going to file patent application for telephone. Already making progress and I believe we will soon overtake Bell.](#)³⁶

Events soon unfold. [Your Excellency, graciously allow me to present you with something which is set to turn the world — and particularly telegraphy — upside down: the telephone. Should this thing not yet have found its way to Russia, this would doubly please me. Here, the Postmaster General has taken up the idea with great enthusiasm and has already installed telephone stations! We first demonstrated it at the opening ceremony of the Kiel-Frankfurt cable line in Kiel. Please find attached to this dispatch the official instructions of the telephone, in addition to other poetic outpourings, as composed by our internal scribe.](#)³⁷

HUGE DEMAND

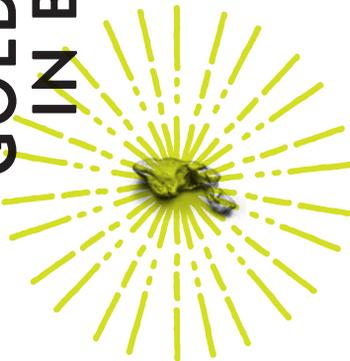
Truth be told, however, Werner remains skeptical. He wants to be involved, but he just doesn't really believe in the telephone. But the technology certainly seems to have struck a chord, and the enormous demand causes Werner to regret his own naïve pricing structure. He writes to his brother, William, on November 19, 1877: [The hype in Germany over the telephone is in full swing, and I can honestly say there will be no containing this spirit we have unleashed! Today we received approximately 100 letters requesting delivery of telephones, and this is a daily occurrence. That is in addition to the Berliners who have completely besieged our shop](#)

and good friends who—if only on an ad hoc basis—have seen it and want to chat about it! It is a veritable calamity! Unfortunately, I have set the price too low at 5 marks a piece. We're still making 50% and I wanted to keep a grip on things with the lower price, but I had certainly not foreseen such demand.³⁸

Business is booming, and word also reaches the ears of Alexander Graham Bell. Today I received a short letter addressed to S&H from Professor Bell in which he says that he has heard tell that we are producing and selling telephones. He asked for swift confirmation of this fact. I have responded to him (in German) that we, like so many other mechanics in Germany, are within our rights to produce and sell telephones of his design. That he failed to patent his lovely invention in Germany quickly enough means nothing will change.³⁹ Werner is in no mood to allow his flourishing business to be damaged and invests in further development and fine-tuning of the device. He reports further

GOLD RUSH IN BERLIN

Even the level-headed Berlin engineers are electrified by tales of the fabled treasure in the Sacramento River.



In California in January 1848, James W. Marshall builds himself a sawmill on the Sacramento River. During its construction, Marshall finds some nuggets of gold in the river. It would soon emerge that there were plenty more to be found.

Gold—just like that, lying there in the water. His boss, Johann August Sutter, issues instructions for people to keep it completely quiet—without success. Someone lets the cat out of the bag. News of the discovery spreads like wildfire («Gold in the Sacramento River!»). At first, only a few people come. But in the end, hundreds of thousands of people are inspired to travel to California. The California

success to his brother Carl in London on December 7, 1877: *We reached the figure of 700 telephones a day — delivered. The storm now seems to be subsiding somewhat and a vast quantity of competitors have started up. [...] Some deliver for as little as 3 marks a piece!*⁴¹

The business with the telephone maintains Werner's keen attention, as does the constant cooperation with innovators in science, government, and administration — including the legendary Postmaster General Heinrich von Stephan.

AN ADMINISTRATIVE HERO

Heinrich von Stephan is one of those heroes of administration, of unruffled intelligence, who generally remain unknown. Someone with vision. Someone who makes Berlin a technological hub, a decidedly modern place. A civil servant, von Stephan is Postmaster

Gold Rush has begun. In the ten years after Marshall's find, gold worth more than half a billion dollars is found in California. The news travels as far as Berlin, where it reaches the ears of the Siemens brothers.

Before 1848, hardly any Europeans had settled in California. Most people who came from the Old World stayed on the East Coast. But the gold changed everything. By 1849, more than 80,000 people were heading west: particularly from Europe. Riches beckoned. In the Siemens family, too, the word «gold» is on everyone's lips. Carl, then 20 years old, and Fritz Siemens, 23, are keen to set off. Werner gives his consent. On the one

hand, he is sorry that Carl and Fritz intend to give up their lives in Europe; on the other, he sees the opportunities that beckon in the New World. In the end, though, it remains just a dream. Neither Carl nor Fritz left for America. Werner has his own ideas about it, anyway: *I believe, incidentally, that one is much better off going there with the intention not of searching for gold, but to make it. The cost of the effort will have to be accounted for, and as prospecting for gold has become an obsession, this work will be the worst. Brewing beer, distilling schnapps, making tools etc. will be the best search for gold,* he writes to William in January 1849.⁴⁰

General of the northern German post office from 1870 and Reich Postmaster from the declaration of the German Empire. Von Stephan is the visionary who connects Germany, the key figure who turns postage across the empire upside down, who champions the telephone as a means of communication — and who turns Berlin into the Silicon Valley of long-distance communication. He also invents the postcard, creates the Reichsdruckerei (known today as the Federal Printing Office) and accelerates the growth

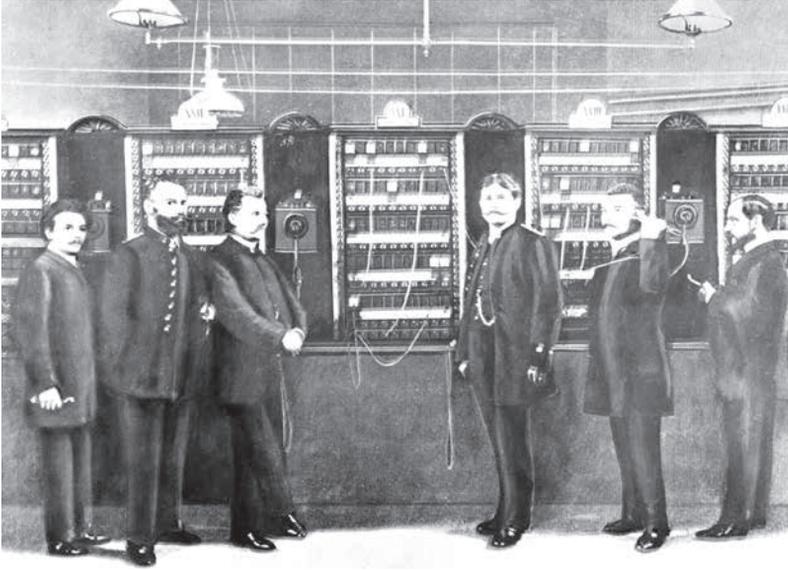


ADMINISTRATOR AND VISIONARY

Heinrich von Stephan, circa 1855

of telegraphy, first in Germany and then across the world. Von Stephan realizes early on the political and economic potential of the telephone and the real-time communication it enables. The secret to his success is his openness and receptiveness to all that happens in the world.

When von Stephan reads about Bell and his new invention, the telephone, he is excited and immediately orders a set. He uses the new devices to connect his office building on Leipziger Strasse to the General Telegram Office on Französische Strasse. And? It works. The civil servant is convinced and telephony in the German Empire is born. It is October 26, 1877.



THE FIRST GERMAN TELEPHONE EXCHANGE IN BERLIN
(with manual operation), installed by Siemens & Halske, 1881

THE BOOK OF FOOLS

The number of telephone devices in Berlin grows rapidly as Werner and others jump on the new technology. Berlin's first phone book appears in 1881, and von Stephan lobbies banks and businesses for investment in the new technology. At first they are skeptical and unwilling to invest; indeed, the first phone directory is quickly nicknamed the «Book of Fools.» But von Stephan is determined.

Seven years later, there are more telephone connections in Berlin than in any city in the United States. It is an unprecedented success and turns Berlin into a hotspot of global technological development.



HONORED BY THE KAISER AGAINST HIS WILL

From then on: Werner von Siemens, 1888

SCIENCE: FOREVER YOUNG

Werner quickly becomes a busy «enabler» of the natural sciences. Always on the go, he manages to convince both politicians and the nobility to invest in STEM subjects.

He doesn't just think of himself, nor only of his business. Werner strives, above all, for scientific advancement — and is determined that Berlin should lead the way. Throughout his life, Werner's brimming spirit is most evident in his community engagement. A leader who today, would be called a trendsetter. His principle concern always remains the same: scientific progress.

One example is the Patentschutzverein (Patent Protection Association), where Werner is an early advocate for the protection of inventors. [The Patentschutzverein of the German Reich, which has been successfully established and the presidency of which](#)

I am honored to hold, takes up much of my time. But it is a great success! All major industry and scientific technology in Germany is represented in the association and a large number of technological associations have confirmed their entry with substantial contributions!⁴²

To maintain technological progress, Werner knows the city needs a scientific base, a research center, an institute of the Reich dedicated to scientific endeavor,⁴³ he says. In other words, an early institute for STEM (Science, technology, engineering, and mathematics) subjects.

PERSISTENCE PAYS OFF

Werner writes to ministers and administrators on the matter, which is close to his heart. A letter to Dr. Rosenthal for instance, reads: It is my intention to establish an institution of the Reich, the purpose of which is not to teach, but is dedicated to scientific endeavor. To this end, I am prepared to make substantial personal sacrifices. However, Bismarck still considers science to be a form of sport devoid of practical meaning— and this view is quite widely held. With this submission, I intend to usher in an effective public campaign for the recognition of the significant social importance of scientific research.⁴⁴

Or one addressed to Minister von Gossler: Your Excellency has generously received my offer of July 7 last year, regarding handing over a suitable site on Marchstrasse in Charlottenburg to the state, for the establishment of an institute for scientific research in accordance with the decree of July 13 last year. [...]

My desire to support the completion of the envisaged institute, combined with the fact that I have decided to use my share of the inheritance of my late brother, Sir William Siemens of London,

not to boost my own private fortune but to continue my brother's unwavering endeavors to support the public good to as great a degree as possible, leads me furthermore to offer to assume the cost of construction of the necessary buildings.⁴⁵

Werner's plans are soon fruitful. In October, 1887, the «Physikalisch-Technische Reichsanstalt» (Physico-technical Imperial Institute) begins work on the main building of what is now the Technical University of Berlin. It is the first state-funded, non-academic major research facility—the result of Werner's persistent campaigning. Not only did he donate the site on Marchstrasse, but he also provided a substantial start-up fund which enabled him to exert some pressure on the authorities, greatly contributing to the success of the plan. Without it, none of the plans would have been possible.

Werner writes to Alexander Siemens: *I can say only that it is a Reich institute with two departments. The first, the technical institute, is to be established at the Charlottenburg Polytechnic and is intended set standards for scientific and technological matters. Linked to it is a mechanical workshop where, among other things, standards of electrical metrics are to be established and tested. This institution for electrical metrics standards will employ a director and four assistants for the various departments. The improvement of precision engineering is a key aim. Loosely connected is the institute for scientific research, a result of my own impulse, and I have offered the 20,000-square-meter site in Charlottenburg required for its construction to the Reich, on the condition that the Reich assumes construction and remuneration costs. The institute director will always be a leading German physicist, starting with Helmholtz. He shall also assume the role of President of the Board of Trustees for both institutes, which shall remain inseparably one. [...] Three full-time assistants will be employed and young academics who have proven themselves as able researchers will have the opportunity to take on paid research positions, supported*

by the Institute. The site which I have donated is valued officially at half a million marks and the total construction costs for both institutes will come to 1.5 million. Both will be subject to maintenance costs of approximately half a million marks.⁴⁶

The project is a total success, and the institute sets the bar for further metrological state institutes in other leading industrial nations of the time. Credit goes to Werner Siemens, who will soon be invited to change his name in recognition.

THREE NEW LETTERS IN HIS NAME

In 1874, Werner is accepted into the Royal Prussian Academy of Sciences, for him one of the most significant honors of his life. Even the German Kaiser, Friedrich III, is impressed by his dedication and indeed by his entire career as an inventor and businessman. The Kaiser is a liberally-minded man who recognizes the value of Werner's work to the young German Empire by honoring him with a noble title «von Siemens.» Werner, however, finds the honor somewhat embarrassing and later plays down the accolade: *With regard to this inane ennoblement, it simply cannot be helped. Unlike a pardon, it is not granted in the customary manner upon prior request, but is rather bestowed as part of the Kaiser's accession to the throne. A rejection is out of the question, as such a request would cause the mightiest uproar, for which I have no desire, not even if it worked. I will remain as I always have been, with or without the three letters.*⁴⁷

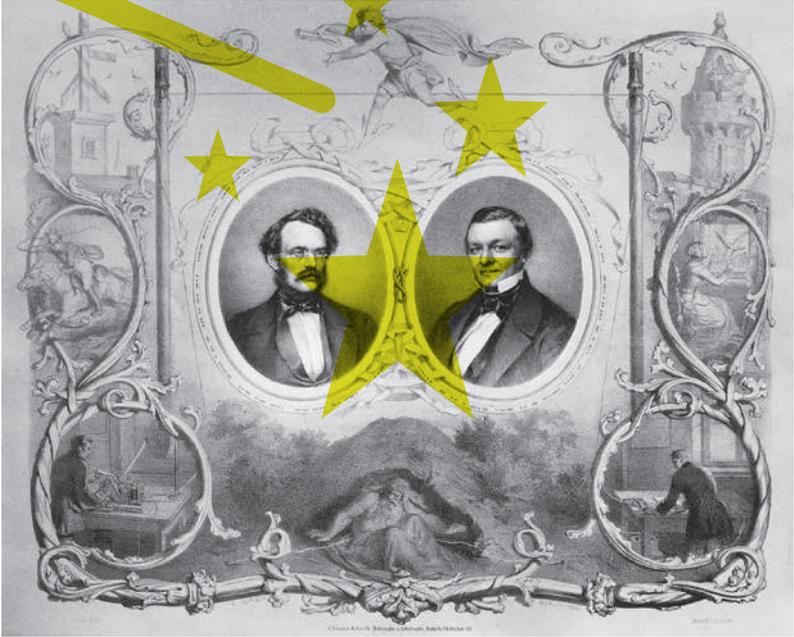
The liberal Kaiser passes away shortly after Werner writes these lines to his sister Sophie Crome on May 11, 1888. The Kaiser reigns for only 99 days. Werner dies four years later in 1892, by which point the United States is gripped by economic crisis. General Electric is also founded that year, and is today the largest competitor of the Siemens company.

GLOBAL AMBITION

Great successes

A company on the rise: Werner sets out to turn the world upside down. Persistently and instinctively, he works closely with Johann Georg Halske and his brothers on revolutionary products made for a new, exciting era.

Werner is a discoverer, networker, and advocate. He soon becomes a responsible businessman as well — much more than just an inventor and scientist.



DRIVE AND FORTUNE Contemporary depiction of company founder Werner Siemens and Johann Georg Halske, circa 1855

POWERFUL MAGIC

*For Werner's global ambition, it takes talent, vision, and in particular, the will and audacity **to chase down good fortune.***

There's a **powerful magic** in saying **I want**. It is 1854, and Werner is struggling. Although the company is making headway in the Russian market, Werner has lost the Prussian state as a customer. An international corporation, and the **global enterprise à la Fugger** that Werner has in mind, is still a long way off. Yet he still has a

clear, unclouded view of himself and his work. In March, 1854, Werner writes his wife Mathilde: *With careful contemplation and active engagement with the dreaded wheels of fate, one can achieve quite a lot, avert some disasters, and turn certain enemies into friends. There's a powerful magic in «I want,» if it is meant in earnest and if there's some conviction behind it!*

At the same time, he notes: *It's going to be a topsy-turvy year for us, my dear, poor Tildchen. I'll be able stay at home barely six weeks, and won't be able to return to familiar, comfortable quarters until the middle of July [...] when the facilities are completed here. [...] Admittedly, Fortune must smile on us as well, or all the work will be for naught. But a man must be daring enough to chase down good fortune, and there is no better time for us than right now. This time, if put to good use, we can put all our worries to rest for life!*¹

Werner turns away early on from an orderly, secure working life, in favor of freedom, which he feels *called* to — freedom of mind, freedom of action, and the freedom to decide. He remains every bit the «brimming spirit» he has always been. Life isn't completely carefree, however. Success is scarce, and there is so far no means for large investments. But Werner remains calm: the business plan, his ideas, and especially his innovations, are good. It would just take a little time for them to prevail.

THE THINGS THAT MATTER

Werner's determination is as deeply-rooted as his faith in himself. Years later, in 1886, when Siemens & Halske is a well-established company worth millions, employing around 2,600 people and making products that are sought around the world, Werner looks back on his pioneering decision. *As far as I'm concerned, I decided almost 40 years ago between the civil service or the private sector.*

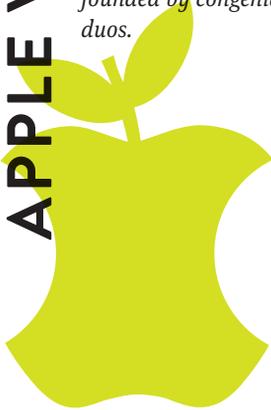
I was in favor of the latter, solely because it spoke to me more and I felt called to independent work. Many friends regarded this decision — which brought me no secured position in life — to be careless or foolish. But it all depends on what one feels called to do!²

NO REMORSE

Others may have found it foolish, but in reality it is a courageous decision to try something based sheerly on the belief in one's own destiny and assertiveness. Who else would have ended a well-paid and reasonably interesting position in public service with no money saved, while also being responsible for the wellbeing of younger siblings? Most likely only a person who feels compelled to become an entrepreneur.

IN THE APPLE VALLEY

It's not always individual people who turn the wheels of technological history. Many significant inventions have been made and companies founded by congenial duos.



Sometimes, two people meet and are instantly on the same wavelength. They know what they want and have no need for long explanations. What matters is the unreserved trust in one another — and above all the certainty that they complement each other well. There are numerous examples of this, especially in the recent history of the foundation of major companies. Steve Jobs and Steve Wozniak, Larry Page and Sergey Brin, William Proctor and James Gamble — and not forgetting the Aldi brothers, Karl and Theo Albrecht, who turned a little corner shop into a supermarket giant. Another impressive example is the co-inventors of standard application software: five friends who quit their jobs at IBM in 1972 when they decided they'd had enough of clocking in day after day.

In March, 1849, Werner is determined to completely retire from public service. Shortly thereafter, he makes this decision. In June 1849, I requested my discharge from the military service, and soon afterward also resigned my office as technical manager of the Prussian state telegraph.³ Werner had already patented his pointer telegraph in 1847 and was working on a gutta-percha press to extensively improve the insulation of telegraph cables. Prior to that, he had rebuffed his sister's request that he seek a job as a physics professor in Kiel. He is not interested, and didn't have the formal qualifications anyway. At the beginning of January, 1847, he writes to his brother William in England: A few days ago, fate offered me another comfortable and meritless path to a carefree existence. I rejected it and opted for the burdensome way of succeeding through my own work. The decision has been made, and I feel no remorse!⁴ Hence: no Professor Siemens.

Instead, they decided to pin their hopes on real-time on-screen processing. They named their company after the service they were offering: systems analysis and program development, or SAP for short. Many of the great breakthroughs in astronomy, physics, chemistry, biology and medicine were made by far-sighted individuals, but many were also made by collaborative researcher duos. The same is true of technological breakthroughs: from the printing press to the steam engine, the airplane and the computer, pioneers – whether individuals or teams – were always people who liked to fiddle with things, people obsessed with their projects, who would pursue their ideas in spite of setbacks and ridicule from their colleagues. Many technological

inventors didn't and don't want only to tinker with inventions. They also want to implement their business projects and supply a market others often can't even see. In 1939, the HewlettPackard company was founded in a small town in California. These days, everyone knows the name of Palo Alto, that sleepy little town in the Santa Clara Valley south of San Francisco, as well as the valley in which it lies. Known today as Silicon Valley, it is a synonym for the new digital age, but the valley was originally famous for its apple orchards. Since the early 1980s, it's known as the place where Steve Jobs and his partner Steve Wozniak chose a bitten apple to be the logo of a future technological empire.

Instead, he feels an awakening; «I want» persists. As much as the new natural sciences fascinate him, he is not, first and foremost, a tinkerer, inventor, or scientist. He knows that quite well himself. Ideas themselves have very little value. The value of a discovery lies in its practical implementation; the value of that is the thought that goes into it and the amount of labor and money invested.⁵

AHEAD OF THE TIMES

Entrepreneurial vision seems to be what connects it all: the foresight to join multiple individual technical possibilities into one, and in a way that could fundamentally change people's lives for the better. It applies to Mark Zuckerberg at Facebook just as it did to Carl Benz, who made the first petrol-powered car with an internal combustion engine and electric ignition ready for production in 1885. The fact that Benz's inventions, along with those of his competitors, Gottlieb Daimler and Wilhelm Maybach, would revolutionize mobility, went beyond the expectations of many contemporaries. The same could be said for Werner's inventions.

The thing that unites all great creative minds is their predisposition for innovative change. They can already see the shift beyond technical disruptions. And no matter how crazy or impossible their goals often initially appear to be, their decision to pursue them is always clear. They embark on these journeys with eyes wide open, knowing their innovations are far ahead of their time. A purely entrepreneurial business requires young, daring leaders who are always ready to put their existence on the line in the interest of conducting big business. The company is, at the moment, in bloom. A manufacturing and supplier business can outlive generations, and that is more to my liking, Werner writes to his brother William in November, 1867.⁶

It was Werner's expectation and aspiration that his work would **outlive generations**. He does not want to be defined solely as an innovative businessman and technology entrepreneur. He wants to deliberately bring about the transformation from start-up to widely-diversified company. In concrete terms, he learns early on that diversification and a range of products — placing eggs in many baskets — is a wise strategy if his dream of a **global enterprise**, a highly-regarded internationally-operating company, is to become a reality. Werner strives to create a company that he feels obliged to run responsibly, with regard to society as well.

But before the race can begin, Werner needs a partner.

BERLIN'S BACK YARD START-UP

The story of the entrepreneur duo Siemens and Halske begins in a back yard in Berlin. It is there, at Schönebergerstrasse 19, that the «Telegraphen Bau-Anstalt von Siemens & Halske» (Telegraph Construction Company Siemens & Halske) opens its first workshop. Their encounters with each other go back as far as meetings of the Physical Society. Both have already established names for themselves — as a sharp inventor with high technical expertise, and the other as a device maker and clever specialist for all manner of technical solutions.

But it isn't until the two meet each other through Emil Heinrich Du Bois-Reymond that the wheels are really set in motion. Halske takes apart the advanced prototype of the telegraph — made by this bundle of energy with wild hair named Werner — and examines it closely. After that, he knows that this Siemens fellow has taken several smaller innovations and put them together in a single brilliant idea, significantly improving the pointer telegraph of the English inventor Wheatstone. Wheatstone's device was powered by turning a crank. If the telegraph operator cranked too



FROM THE GARAGE INTO THE WORLD

View of the workshop at
Schöneberger Strasse 19, circa 1847

fast or too slow, the message was not transmitted properly. Werner's improvements include an automatic interruption of current when a key is struck. It is technically complex, but it improves the reliability immensely.

There is one thing Werner is unable to do: produce the device in the necessary quality himself. It doesn't take long for Halske to join forces with Werner, and later they will become friends. But

the mutual admiration must have been strong from the start, otherwise they wouldn't have become neighbors in apartments above their workshop. It is simply a good fit. On September 15, 1847, Werner Siemens writes his brother William: *After a long search, we've finally found and rented quarters, fitting for our new workshop. The windows face out toward the Anhalter train station. [...] I live on the ground floor, the workshop is on the first floor, Halske on the second, for a total of 300 thaler. Work will begin soon after October 1.*⁷

GLOBAL ENTERPRISE À LA FUGGER

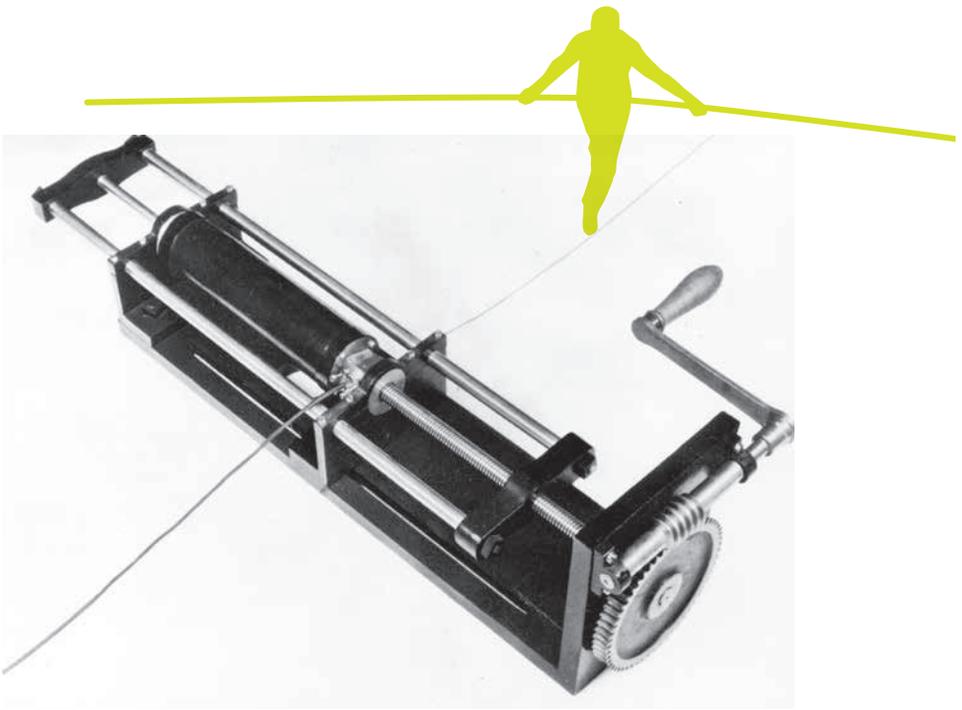
The initial capital for the company does not come from a bank, but mainly from a relative: Johann Georg Siemens. He takes on the role of business angel and contributes 6,842 thaler — the approximate amount needed to establish a limited liability company today. The investment makes Johann Georg Siemens a silent partner entitled to 20 percent of profits — if there are any. One person is convinced from the start that things will go well. *Since my youth, I had always dreamed of a global enterprise à la of Fugger, which would provide not only myself but also my descendants with power and prestige in the world, as well as the means to lift up my siblings and close relatives to higher status in life,* Werner writes retrospectively to his brother Carl in 1887.⁸

A HEALTHY DOSE OF PIGHEADEDNESS

In some respects, Werner Siemens and Johann Georg Halske are quite different characters. Halske does not share the dream of becoming an international businessman. He is more aesthetically-inclined than Werner, enamored with the art of handicraft. That will not become a fundamental issue until a few years later. But in other respects, they are cut from the same cloth — the reason

they quickly develop fondness and trust in one another. Their mutual fascination by the natural sciences unites them as well.

Halske's teachers at the renowned secondary school Zum Grauen Kloster in Berlin say he characterized the spirit of freedom. He leaves school at 15 — without a diploma. His biography records the basic traits of his personality: «Dedication and enthusiasm, coupled with free-spirited tendencies and a healthy dose of pigheadedness and persistence.»⁹ Not the worst qualifications for starting a company. Werner is enthusiastic and obsessed with detail as well, and is also interested in technology and applied sciences. He, like Halske, possesses an entrepreneurial streak. In short: Siemens and Halske bring the perfect mix of similarities and complementary traits to the company. They are exceptionally wise in the division of responsibility as they build up their new joint venture.



PRODUCT, PATENT, MARKET Everything is in place, save for the coveted funding. Werner's audacity leads him to misuse his father-in-law's money. Gutta-percha press, 1847.

ALL A MATTER OF NERVES?

Werner is in trouble! He takes every financial offer, invests it, and keeps the business on track.

A love of freedom and perseverance are certainly considered fundamentals for aspiring entrepreneurs. But sometimes a bit of audacity helps maintain focus on what matters. In the midst of dire financial straits, for example. Some turn to bankers and beg for credit, others seek dubious investors and risk more than they would like. In his own hour of need, Werner turns instead to a man who would later become his father-in-law. In 1846, before he

starts the company with Halske, Werner takes the money entrusted to him by his future father-in-law and uses it for ... well, for another purpose. Instead of investing the money in maintaining his relative's grave, Werner uses it to avert his own financial bust. Or, to put it another way, wisely invests in his own vision.

Wilhelm Drumann, one of Werner's admittedly distant relatives, entrusts Werner with the money to adorn the grave of Drumann's late wife in Berlin. But rather than investing in floral arrangements, Werner uses the money to quickly fill gaps in his own budget. [Nearly everything I undertook failed, the difficult financial situation tied my brother's hands in England, and we were deeply in debt and on the brink of ruin](#), he explains to Drumann later in defending his actions. He maneuvers tactfully to persuade Drumann — and is successful. Rather than telling Werner to go straight to hell, Drumann loans him the money.

HEAVY BURDEN

Having already misappropriated the money, in his letter to Drumann on January 12, 1847, Werner is unusually sheepish: [My fatherly friend! \[...\] You trusted me with a sum of money to safely invest and secure the care of your dearly departed's grave at the church or somewhere else. Initially, I was unable to find a suitable place. Then I came to be greatly pressed for money. You are aware that because of my brothers, my expenses are not in line with my secured income. My hopes were on the prosperous success of my industrial enterprises, which, so far, have provided me with sufficient funds. Last year was not a good one for me. \[...\] But our spirits remained high, and separately, we have both entered a new realm of activity, and hopes of thriving success have already begun to replace the onsetting despondency. However, I still bear a heavy burden — I spent the money you entrusted to me without your permission, and I am not yet able to put it toward its original](#)

purpose! I ask now for your belated consent to do what can no longer be undone.¹⁰ Werner writes this letter a few days after the New Year's Eve meeting with his future associate Halske, when they reach an agreement on the construction of the pointer telegraph.

WITH WARMEST THANKS

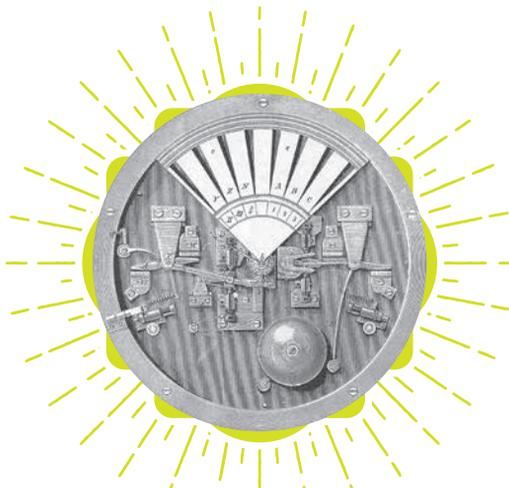
Wilhelm Drumann turns out to be understanding. He must have also believed in Werner, who sends a note of thanks on January 25, 1847. *My honored friend and cousin! [...] I accept with pleasure your kind and loving offer of a loan. It gives me the mental freedom to banish the worries of the immediate existence and to focus all my strength on implementing my plans for the near-future. [...] Please allow me to include a certificate of my debt, as order dictates in money matters, along with my warmest thanks.*¹¹

On the same day, he tells his brother William, that a delicate situation had been avoided thanks to Drumann's loan. *You see that I am not idle, and have much to do and take care of. It is however high time that I make progress if I want to stay on top. If Louis and Hans, cousin Georg, and, a few days ago, Drumann (!) had not stepped in with financial help, I would have had been bankrupt long ago.*¹²

PROVIDING WHAT IS LACKING

Becoming a businessman means having the nerve to maintain a permanent balancing act. Things can go wrong at any time, but they can take a positive turn just as quickly. On October 1, 1847, Siemens & Halske is launched. A few weeks earlier in August, 1847, Werner writes William: *At the moment, this is how things are looking: I have definitively agreed to build a workshop with Halske, the mechanic who recently separated from his associate, and it will hopefully be fully operational in six weeks. [...] Halske,*

who is an equal partner in the factory, will manage it, while I will manage the lines, contracts, etc. For now, we only want to make telegraphs, signal bells for railways, and gutta-percha isolated cables, but I think we'll simply call ourselves a «construction company» to keep our options open. What do you think? The necessary capital isn't actually very much. A few thousand thaler are sufficient for the plant, and, if we're lucky, we can bring in a hundred times that per year. Such a facility is completely lacking so far, leaving us without competition, and well-protected with my patent and my already considerable influence.¹³ Werner makes a decision and places all his faith in telegraphy. He will be proven right. In November, he writes his brother William: *Electricity is our spiritus familiaris! It will pull us from the muck.*¹⁴



EASY TO OPERATE Partial view of the pointer telegraph, 1847

THE NEXT BIG THING

Entrepreneurship is more than being inclined toward innovation and keeping control of the cash flow. It is also «people business,» and the ability to draw the correct conclusions from setbacks.

In the mid-1850s, the telegraphic system is considered the means of communication for the industrialized world. Fifty years earlier, it had already hailed as a technological marvel. «The capitals of distant nations may one day be connected by strings of telegraph towers,» the Encyclopedia Britannica prophesized in 1797. Later research on the electric telegraph and the development of devices for using it comes from inventors and pioneers such as Wilhelm Weber, Carl Friedrich Gauss, Michael Faraday, Charles Wheatstone, and Werner Siemens. In the early days of the telegraph, there are many methods of sending and receiving messages. Much is tested, improved, and rejected. The only certainty is that the wired telegraph is the first significant application of the miraculous substance, electricity.

The breakthrough in telegraphy comes with Charles Wheatstone's pointer telegraph. It is based on a manually-adjustable pointer

whose position is sent to a receiving device, bringing the pointer on the receiving end to the same position. This enables individual letters of text to be transmitted. But the pointer telegraph is still quite unreliable. It is Werner who makes the device dependable and suitable for the masses by equipping it with self-regulating gears, a reliable system of magnets, and secure contacts. Others, such as the American, Samuel Morse, develop a writing telegraph and a code to go alongside it that soon make it possible to transmit longer messages quickly and reliably.

DELIGHTFUL TIMES FOR ENTREPRENEURS

Initially, the new form of communication is under the nearly-exclusive control of the military and government agencies. But the world is changing. Soon, railway companies are also implementing the fast method of communication. News about arriving and departing trains is said to be faster than the trains themselves. The transmission of messages is a vast new market — with disruptive effects, as proven in Prussia in 1849. In that year, administration of the telegraph is moved from the war ministry and placed in the department of commerce. Following the foundation of the «Königlich Preussische Telegraphen-Direction» (Royal Prussian Telegraph Commission), from October 1, 1849, telegraph transmission is available to private citizens. For entrepreneurs with ideas and courage, they are delightful times. Werner, a former lieutenant and restless spirit, wants to succeed as a businessman by bringing scientific progress to the masses and changing the world. The best part: he is finally free from military service and is his own boss.

He found a partner, started a company, and was working away on his product. The business model is set; contacts to the military and administration are in place.

But then comes the trouble with Nottebohm, brought on by faulty cable insulation. It isn't caused by shoddy workmanship or rushed production. Instead, the disaster is caused by adding sulfur to the insulating material. Once buried in the earth, this substance oxidizes and turns into copper sulfide, which damages the line. Due to the constant interruptions in the telegraph lines, in 1851, the head of the Prussian telegraph commission — Nottebohm — ends that and all future contracts with Siemens & Halske.

THE EARLY DAYS OF TELEGRAPHY

Werner's most important customer is gone, the product is not yet ready, and his reputation is seriously damaged. Bridging long distances is meant to be «the next big thing,» but the lines are corroding. Werner seems to suspect as early as 1846 that the path to a new age in communication will not be entirely smooth.

Telegraphy will become its own, important branch of scientific technology. I feel called to help shape it somehow, as it is still — in my opinion — in the early stages of its infancy,¹⁵ he writes to his brother William on December 14, 1846. Werner recognizes precisely the one thing that will take him further. He focuses himself, as we would say today. He becomes a successful businessman not least because of this ability. A person who is focused draws the correct conclusions from a setback. William sees it exactly the same way, and responds to Werner two days before Christmas Eve in 1846:

«It pleases me to no end that you have come to believe, as I have, that it is wholly necessary to have a single, concrete goal in mind, placing all hope and all efforts into achieving it. I'm glad to hear you have set your sights on the electric telegraph, not only because this suits you quite well, but also because the significance of the matter will satisfy your ambition. [...] If I may give you some advice, seek to find a contract that relates to the electric

telegraph! If you can succeed in that, it will certainly be easier in Prussia (where you are best-known) to receive the construction of a line. I advise you to apply for foreign patents, especially in England, where the enthusiasm for the electric telegraph has not yet been awakened. [...] If we can keep our heads above water and build upon performance, you'll find thereafter a fruitful field.»¹⁶ The brothers' instinct and strategic talent forms the foundation of the company's later rise to a global business. Focus also means rising after a mild setback and continuing to pursue goals in a different way. Perhaps abroad, perhaps in London.

SEARCHING FOR FAULT WITHIN

The Nottebohm crisis is indeed the first serious one for the company, but it is simultaneously the birth of a global player, forcing the brothers to try their luck abroad. The first opportunity to raise their profile is at the first World's Fair — the Great Exhibition — from May to October 1851, in London. The once-in-a-lifetime event is a congregation of modernity in a huge glass palace in the middle of Hyde Park with more than 17,000 exhibitors from 28 countries. The pointer telegraph from Siemens & Halske gains a lot of attention. Presenting their innovation in London brings the company its first international recognition: the pointer telegraph is awarded the «Council Medal.» Even at this point, Werner's motto, which he would form later, proves to be true: **But it is quite difficult to follow the simple rule of first searching for fault within — this essential principle of telegraphy — but over time, you get a feel for it, if you hone it at every opportunity and treat obstinacy as a capital crime!**¹⁷

RUSSIA OR BUST!

The Siemens brothers embark on a new path — and it leads east. Wise networking points to the way ahead.

In just one year, Werner experiences great change. [The year 1852 formed a decided turning point in my personal as well as in my business life](#), Werner writes in his memoirs.¹⁸ It is the year he marries Mathilde Drumann, the daughter of his investor. The year also sees the beginning of highly-successful work in Russia. The Nottebohm crisis had impacted the company, and they are no longer welcome in Prussia. But, during this time, Russia proves to be a promising market for the telegraph. Siemens & Halske learn that Czar Nicolas I is quite interested in the new invention, and Russia is in the midst of a technological boom. The first rail connection between St. Petersburg and Moscow comes into operation in 1851. Things are in motion in the great empire, and a pair of Berliners are on board.

THE PATH TO GLOBALIZATION

[If you settle down here, later — if it seems worthwhile — we want to make a separate branch for the Russian business, in which you would be a partner. Telegraph installation and other consignments and enterprises that might come up could make such a business very good and profitable. Russia is a country with lots of potential if one knows the lay of the land](#), Werner writes his brother Carl in July 1853.¹⁹ They don't only know the country, but they also know the right people. Werner already has a good relationship with the Russian officer Count Alexander Lüders, with whom he had been able to arrange the delivery of 75 pointer telegraphs in 1851. His



COUNT PYOTR KLEINMICHEL,
Companion in Russia

confident manner with other people helps Werner on his way toward becoming a successful global entrepreneur. Today, we would refer to strong communication skills, or social competence and networking ability, which in principle, mean nothing more than meeting other people and getting to know them. But the motto remains the same: It's not important who I know, it is important who knows me. Werner proves to be a very talented communicator and, above all, a clever networker.

THE COUNT'S CONFIDENCE

In 1852 and 1853, Werner makes a total of three trips to Russia, each lasting several months. It is here that he meets Count Pyotr Andreyevich Kleinmichel, head of the Russian telegraph administration. Kleinmichel has a lot of power and makes decisions on issuing contracts in public affairs. After Werner convinces Kleinmichel of the Siemens & Halske products, the company is contracted to build telegraph lines. In 1853, after the contract for construction of the St. Petersburg-Orianenbaum-Kronstadt line



CARL SIEMENS,
Manager in Russia

is signed, Werner sends his brother Carl to St. Petersburg as the company's representative, and business booms. Some of the credit goes to Count Kleinmichel, as Werner later writes in his memoirs: Count Kleinmichel's power was then so great that, as long as the Emperor Nicholas lived, no one ventured to resist it. The count had acquired confidence in me, and afterward bestowed the same in a very marked degree on my brother Carl. To his powerful protection alone did we owe it that we were enabled successfully to execute the great works which he entrusted to us.²⁰

FINDING THE RIGHT SOIL

The company receives a decisive boost in Russia. Werner's instinct is correct: if Prussia no longer wants him, he will find a new market. The success that follows is largely to the credit of Carl Siemens. «In spring of 1853, Carl von Siemens arrived in Warsaw ready for action and prepared the construction of the telegraph that would be completed by the summer. The construction of the Warsaw-Mysłowice line was the start of a series of telegraph projects that

eclipsed all of Siemens & Halske's previous contracts,» writes Martin Lutz in his biography of Carl von Siemens.²¹

In just two years, Siemens & Halske lays a total of 9,000 kilometers of telegraph lines in Russia. That exceeds all previous orders by a healthy margin. *It seems the genius of our family is favoring us greatly at the moment. Business is taking on great dimensions, leaving us a little giddy. While I was in Warsaw, and with Carl on the wire in Petersburg, he was able to secure quite large contracts. We'll soon continue building to Nikolaev and Odessa, and another line to Finland. At the same time, he secured the maintenance contract of all Russian lines for the annual price of 230,000 rubles for the next 12 years. [...] Soon, barring any large political setbacks, we'll be at the top. [...] Carl has thoroughly distinguished himself. He has found fertile soil in Russia!* Werner writes to his brother William in 1854.²² The small workshop is turning into an impressive business at a dizzying rate. Prior to the deal in Russia, S&H employed 50 workers. By 1856, this has grown to 330 employees — two-thirds of whom work in the Russian Empire. Revenue tops 267,000 Reichsmark, with an export rate of up to 80 percent. It is a fantastic time that sees the arrival of long-sought success — that is until 1864, when the Siemens brothers lose cables as well as large amounts of money, and Halske decides to go.



IRRECONCILABLE DIFFERENCES
Halske no longer wants to be involved.

THE DEPARTURE

Plagued by self-doubt: Werner suffers from the resignation of his partner. Only Mathilde raises the question, whether Halske may have been right.

Halske's resignation is an understandably heavy blow. Halske's reasons are quite painful for me personally. He said we were both getting too old and too stubborn, and by his constantly yielding, the business has assumed a direction that does not appeal to him. [...] The interests of my siblings have indeed had more influence on the direction of our business than interests from outside of the family. But I had always believed to be acting in the

interests of the business and not for my own personal interests, Werner writes to his brother William in August, 1863. In the same year, Halske had already made the decision to leave the company by 1867. There are «differing opinions» regarding the direction of the company. Halske is the one who values handicraft, while Werner, by contrast, strives for industrial manufacturing and mass production. He sees the mass appeal of a product early on — and the use to the public, the advancement of society, and not least of all, the chance for business success. And yet, Halske’s decision is still hard to take.

A COMPANION DRAWS THE LINE

In the letter to his brother William from August, 1863, Werner writes: [Our partnership contract expires in three years, and the previous conditions are not suitable for an extension. Halske no longer wants to participate, at least not in his current capacity. That calls into question the usefulness and necessity of the Berlin business in the first place. After the Russian journey, we need to be of a single mind to either dissolve the entire S&H business, including branch offices, etc., or to agree on a new formation that is satisfactory to everyone. This decision cannot be postponed. Three years is not a lot of time to wind things down, and progress is not possible without solid footing over a long period!](#)²³

DEEP DISCONTENT

Werner is able to confide in his first wife Mathilde. That includes all the discontent between the brothers, Halske, and even Werner’s friend Meyer. Everything seems to be up in the air. There are many paths to success, but in failure, each person seeks fault in others. Mathilde is the only one Werner can completely confide in. In a letter from Paris in February, 1864, he writes her: [The letters that](#)

finally reached me yesterday on business matters and from Halske himself have left me deeply discontented. This calls for a quick and thorough change! No one is thinking, working, or pushing forward. No one gives reasons for the passive resistance that accompanies every task. At best, there are unmotivated and shallow biases! They are like old women who accept the good in silence, and when something goes wrong, speak up and say «I told you so!»—and nothing else! Halske is at least consistent. He never wanted to be anything else other than a *ouvrier mécanicien*. In the past he used to at least subordinate himself, but now he has turned to my friend Meyer with his narrow horizon and wounded vanity. Their negativity leads to nothing other than making it impossible to continue running the business. It won't work as a purely-Berlin shop, and I don't want it that way, either!

THE DAMNED CABLE

Werner writes to his wife and tries to make it clear that all is not lost, just because there are differences of opinion at the company and Halske doesn't believe in the cable. *Don't let yourself become infected by the unsavory resentment against William, my dear. He has his faults as we all do, but he is good, hard-working, and capable, and now has a firm foundation for his future, due in part to his reputation as an engineer, and also to the results of the oven building and the cable manufacture. What Halske «constantly» calls the damned cable is, despite it all, the happy solution to the problem and will outlast us all.*²⁴

MAYBE HALSKE HAS A POINT?

Mathilde recognizes the impact of the highly-emotional departure of Werner's partner and provides—as so often before—her understanding, but also critical, remote diagnosis and advice—for even Werner's age-old friend Meyer is proving to be difficult.

On February 15, 1864, having already been diagnosed with her illness, Mathilde writes to Werner and addresses his concerns — while giving him a small taste of his own medicine. «It was painful for me to hear of the discord at your office — it would be better to have these few years behind you, as I fear the rift will continue to grow. My dear husband, arm yourself in your loneliness with wise intent. He with the highest standing can always do the most for peace. But above all don't be so hard! Please don't take offense, my dearest, that I allow myself to make such a reprimand, but it is so dear to my heart! You have become so different, and I often think and fear that you could become like your father in this sense. [...] If only it was possible for you to calmly confront differing views in your office. You could, of course, if you wanted to. You need to, in the interest of self-preservation, as you get so completely worked up with this excess of passion — and secondly, in the interest of your friends. If William Meyer has not written to you, it is surely simply a sign of his sensitivity, and ask yourself if he has his reasons for that.» And then she asks the question that must be raised in such situations: «Aside from that, isn't Halske sometimes right? It is true, after all, that many failings in recent years need not have been so. You strengthen each other with your different approaches, but push each other beyond the right balance — that is folly.»²⁵ But Halske and Siemens will not find a way to reconcile their business partnership. The name, however, remains. Halske leaves a lot of money invested in the company and continues as a silent partner.



SIEMENS GROWS Siemens & Halske factory courtyard on Markgrafenstrasse, circa 1875

GLOBAL AMBITION

Just like Fugger? That is the dream, and Werner is setting the pace in Berlin. His brothers are his representatives in Russia and England.

Werner is striving for business success. He always wants more, right from the beginning. He has global ambition, a company *à la Fugger*, which goes beyond national borders. At this time, a businessman cannot set the bar any higher, especially since Werner's success will not come by means of speculation, profitable trades, or similar methods. No, Werner wants to create real products with real use, for real people — revolutionary ones that change society. Breathtakingly modern, but sturdy.

He sets down to work with great persistence, instinct, and belief in himself — and with partners he can absolutely trust: his brothers. With William and Carl in particular, the Siemens brothers achieve their global ambition. Carl paves the way in Russia, and William on the British Isles. Werner is the catalyst, setting the pace from Berlin.

GLOBAL ENTERPRISE, PART 2: ENGLAND

Sir William is seven years younger than his brother Werner. Born Wilhelm Siemens, in 1844 he makes his way to London. He sees his future there, and relocates. From England, he will bring the Siemens name to the rest of the world. Prior to that, in 1843, Werner and William took a trip to England together, hoping to make money from Werner's gold and silver plating methods. Even though the trip was not a resounding success, William still opts for England. As a representative of Siemens & Halske, his job is to stimulate the cable business in Great Britain and to maintain ties to the scientific community. The underlying idea is quite simple: anyone hoping to connect the world overseas with cables would be wise to start with the leading maritime and colonial power of the time. The leap to far-away America is more conceivable from England as well.

THE NECESSARY FORCE

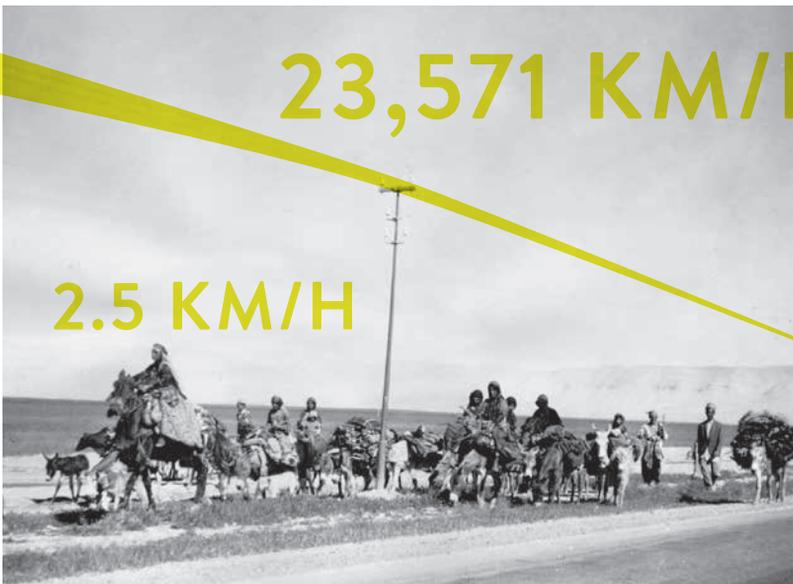
Step by step, the Siemens brothers take over the British market. Werner takes part in a British cable-laying expedition as an expert and writes to Mathilde on September 1, 1857, from Sardinia: *If we can keep this good weather, the cable-laying is likely to succeed. The English gentlemen had a completely false theory, the others none at all. After long disputes in English and French, I had the pleasure of bringing them to general recognition of my theory, which of course significantly improved my slightly skewed initial standing.*²⁶ A few days later, he provides his father-in-law Drumann with a precise description of how to lay an undersea cable and the associated challenges: *The English gentlemen began, as usual, with more audacity and confidence than basic knowledge. They only believed my calculations when the largest portion of the cable had already been placed in the water and the effort could already be seen as a failure. [...] The challenge lies in holding back the cable with the necessary force so it doesn't drop like a stone in deep water. If the depths are great, a larger force must be applied, which can easily lead to tearing the cable.*²⁷ Werner describes here the biggest risks of installation. Calculating the relationship between speed of the ship and the depth is critical for success. Thanks to his advisory efforts, the cable is laid successfully. The *English gentlemen* are open to input from the Berlin businessman. Werner and William are in.

THE SIEMENS BROTHERS

Following the successful cable installation in the Mediterranean between Sardinia and Algeria, the Siemens brothers are able to make a name for themselves on the competitive British telegraph market. More importantly, the British government assures the brothers that they will be tasked with scientific supervision on all deep-sea cable installations from 1857 onward — another milestone

for the company. In 1858, the London business is officially turned into an independent company called «Siemens, Halske & Co.» It succeeds by means of German thoroughness and entrepreneurial daring. The spectacular contracts include laying lines between Constantinople-Chios-Candia and Candi-Alexandria, as well as portions through the Red Sea and Indian Ocean. To make themselves independent of suppliers, at the beginning of 1863, Siemens, Halske & Co. founds its own factory in Charlton, west of Woolwich, for the production of cable.

In 1865, all the necessary arrangements are being made. After Halske's departure from the British business, the London company operates under the name «Siemens Brothers.» Despite the name, William is, without doubt, the one in charge. As the Siemens business grows in England, William benefits from professional and personal contact to Newall & Co. In 1859, William marries Anne



FROM LONDON TO CALCUTTA IN 28 MINUTES The speed of the telegraph overshadows all previous methods of communication.

Gordon, the sister of engineer and Newall partner Lewis Gordon. Shortly thereafter, William becomes a naturalized citizen and officially leaves the name Wilhelm behind. April 12, 1870, marks a global sensation: In the presence of invited guests, the first telegram of the Indo-European telegraph line is sent 11,000 kilometers from London to Calcutta, in a record time of 28 minutes. After two years of construction, the Siemens brothers' grand project survives its «baptism by fire.» On the same day, Werner writes to his brother Carl. *Despite the anxiety and worry, it was quite a success today! As London called Tehran, Berlin-London went down, and there was a laughably bad connection with Kertsch. [...] I called Kertsch on a second line and relayed to all stations. Then it went fine. I called Tbilisi, then Tehran, and used that line to connect with London! [...] Spread the word that the 10 to 12 hours to the Red Sea have been beaten by our one minute to Tehran and 28 minutes to Calcutta.*²⁸

WHAT TELEGRAPHY CAN ACHIEVE

The start of operation for this route provides the foundation for William's legendary reputation in England. It makes Werner a celebrity, too. His goal, as he writes to his brother Carl on January 24, 1867, is to *establish a standard line that can show what the telegraph is really capable of doing.*²⁹ After the world witnesses the famous message being transmitted, the brothers' names are on everybody's lips. They have managed to connect the world. The line remains in operation from 1870 to 1931 and boosts the Siemens reputation. It also helps win future investors. William climbs the ranks of British society. Shortly before his death on November 19, 1883, he is knighted by Queen Victoria, giving him the title of Sir William. By this point, the brothers' global ambition is becoming reality.

First came Germany, then Russia and England. Then, in 1878, the brothers open an office in France under the name «Siemens Frères.»

In September, 1881, Werner writes to his brother Carl full of pride from the International Exposition of Electricity in Paris: *A Spaniard reported to his government that there were only three things of any consequence at this exhibition, and they are: 1. The exhibit from Siemens & Halske in Berlin, 2. The exhibit from Siemens Bros. in London, and 3. The one from Siemens Frères in Paris!*³⁰

The exhibition is the first of its kind, and aspiring industrial nations such as Great Britain, the United States, Germany, Italy, and France take part. It is a gathering of the pioneering technology of the time. Edison presents his patented light bulb, Alexander Bell his telephone. The future is on display at every turn.

GROWING GLOBAL AMBITION

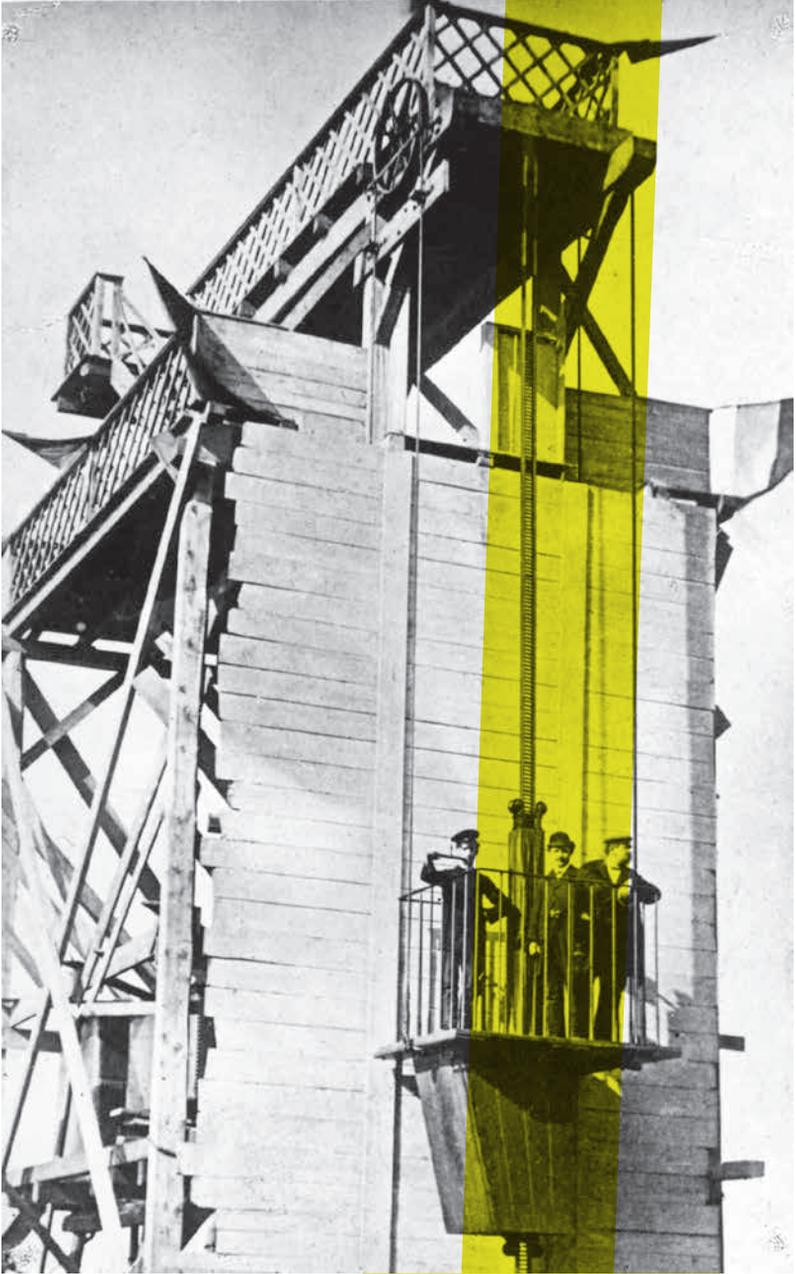
In terms of technology, at the end of the 1860s, all hell breaks loose, and one of those «leading» the technological revolution is Werner. The invention of the dynamo machine (soon appropriately named the generator), the related discovery of the electric motor, and the later development of Thomas Alva Edison's light bulb, lead to new opportunities that deeply impact the economy and society. But the retrospect fascination we have for this historic phase of the electrification of the world distorts the real picture. During these years, Siemens & Halske is a globally-operating company, but in the telegraph cable business. Entirely in the spirit of Werner, what will characterize the Siemens company is already beginning to emerge: Product diversification and entrepreneurship in various fields.

Then, in 1874, the company has around 2,300 full-time employees, 1,601 of whom — nearly 70 percent — work at Siemens Brothers in England. This is a result of the competence of Werner's brother William and the business aptitude of his other brother Carl. It is Carl who plays a decisive role in convincing Werner to vastly expand the factory in Woolwich outside of London. Why?

Because the entire world needs the «Victorian internet» — a fast telegraph connection. The whole world is to become literally wired. From Vladivostok in Russia to Nagasaki in Japan, from Calcutta to Singapore, from Hong Kong to Manila. From Argentina's La Plata to Chile's Valparaíso, from Rio de Janeiro to Montevideo, Siemens & Halske is able to obtain a large slice of the cable installation market and turn itself into a global player.

Global player — it sounds as if the world is their oyster. In reality, it is a nerve-racking business. It means two things in particular, and being open to a new business model is the first. Rather than remaining a manufacturing, supplier, and production business, as Werner wants, Carl and William have a combination of production and operational business in mind. In other words, taking on all the risk, operating as a full-service communications provider, rather than just a boutique for components. Secondly, it means the Siemens brothers are acting as David, taking on the Goliath of the telegraph market; the undisputed top dog John Pender. Not only is he the leading provider for producing and installing submarine cables, but he has also grouped together several telegraph operators under the Eastern Telegraph Company and holds a dominating position in the market.





ELEVATOR IN MANNHEIM World premiere at the Mannheim Commercial Exhibition, 1880

THE GRAND TRANSFORMATION

Electromagnetism powers the rise of the company and showcases Werner's biggest talent of always keeping the practical benefits in mind.

I have had a new idea that will, in all likelihood, succeed and give significant results.[...] It is, in other words, a Holz's machine, used for electromagnetism. We may thereby, with the sole aid of wire-coilings and soft iron, transform power into current, if only the impulse is given. This giving of the impulse, which determines the direction of the current, may also be effected by the magnetism which remains behind, or by a pair of steel magnets which continually give to the nucleus a slight magnetism. The effects will be colossal, given the right construction. This whole thing has great potential for development and can pave the way for a new era in electromagnetism! An apparatus will be ready in a few days. [...] Magnetic electricity will be cheaper as a result and now light, galvanic metallurgy, etc., and even small electromagnetic machines that get their power from large ones will be possible and useful! Werner writes to his brother William on December 4, 1866.³¹

SEVERAL SMALL ELECTRIC MOTORS

When Werner first constructs the dynamo machine — which will make it possible for the first time to convert mechanical energy into a sufficiently strong current without expensive permanent magnets — it is immediately clear that his discovery will open the door to a world of unimagined possibilities. Sufficient energy from a small machine means the ability to generate powerful forces!

To put it another way, the ability to build small electric motors will revolutionize people's everyday lives, particularly when it comes to mobility in the quickly-growing cities.

WAVE OF INDUSTRIALIZATION

Before the prototype of his dynamo machine is even finished, Werner sees in his mind's eye what will change the world 20 years later: the electric motor and its many potential uses. It isn't just the electric trams, elevated, and underground trains that will be powered by these small machines. Skyscrapers in New York, Chicago or elsewhere, these emblems of modernity, would certainly not have come into fashion without the elevator, powered by clean, emission-free, quiet, and reliable electric motors. The first electric elevator is made and presented to the public by none other than Werner himself at the 1880 Mannheim Commercial Exhibition.

Rows of paternoster lifts are built into modern administrative buildings that make a quick change of floors possible. The first are installed as early as 1876 at London's main post office. The first escalator is put into operation in 1895. In 1908, a company called Sanitas unveils a hot-air blower, the first mass-market hairdryer. Truth be told, people can't be asked if they want something, because most of the time, they don't know what they want until it has been shown to them. That was roughly the argument from Steve Jobs when he imagined the iPhone. Despite all the things that separated them in time, this is also how Werner thinks.

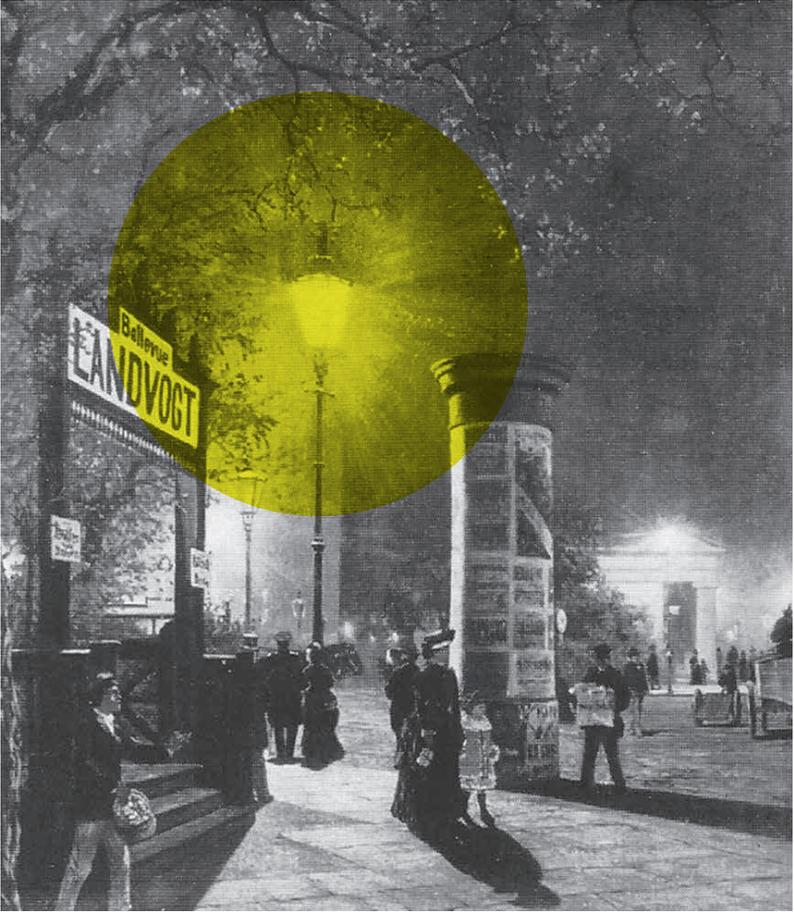
STAYING AT THE TOP

To be an innovative, product-oriented entrepreneur is one thing, but there is a second element at work as well: the desire to stay that way. How does a company stay innovative and intellectually



CIRCUS MAXIMUS Internationale Elektrotechnische Ausstellung (International Electrotechnical Exhibition), Frankfurt am Main, 1891

nimble, today, tomorrow, and in the future? In February, 1882, Werner writes to his brother Carl in Petersburg: **Our great task is to remain at the forefront of electrical engineering. This is no small feat these days, when the whole world is merrily standing on our shoulders and creating electric engineering! If only you had gone through the unending effort and trouble resulting from the electric railway and its practical implementation, and the production of good light bulbs that were much needed to maintain our position and our lighting business [...]. It involves dozens of innovations that need to be made and worked through! People see the finished product without seeing the labor pains that went into it!**³²



LET THERE BE LIGHT Potsdamer Platz illuminated, 1882

NIGHTLIFE IN ELECTROPOLIS

How Werner ushers in the age of the city slicker — and how Berlin becomes an international party hub.

«Berlin for Insiders» is the name of one of the hippest travel guides for the young global metropolis of Berlin. Berlin was indeed hip, much like today: The «Berlin nightlife» proves to be more exciting than that of any other city. Even Paris cannot keep up, according to the unanimous opinion of travel guides and newspaper inserts shortly after 1900. The nightlife of the new global city is legendary: Nowhere else is there such a selection of theaters, variety shows, ice rinks, dance and ballrooms, bars, restaurants, night cafés, amusement parks, and sport arenas, except perhaps in New York City or Chicago. Berlin turns day into night, is brightly lit, and is installing both a modern subway system, as well as an electric elevated railway. Berlin is «Electropolis.»

Werner and his peers in the avant-garde of the new miracle substance electricity lay all the groundwork. By 1879, the production of electric light is ready for market. First come the arc lamps that cast a nearly-glaring light that is bright as day. In the same year, American Thomas Alva Edison is finally successful with his idea to make a filament glow in a glass vacuum to light up a room. He introduces his carbon filament bulb at the Paris International Exposition of Electricity in 1881 to a broad audience. After that, there is no turning back. **The light bulbs will probably soon kill off all the rest and expand the use of electricity to a much wider sphere!** Werner writes in a letter to his brother Friedrich in November, 1881.³³ A few days later he writes to his brother Carl: **We are now eagerly in the process of producing light bulbs, or preparing ourselves to manufacture them. [...] My design differs from the existing one quite significantly, so we have nothing to fear from patents. [...] With one stroke, the incandescent bulb can use electricity to change lighting almost without limit and cause gas to be replaced by electricity.**³⁴

Light bulbs are soon lighting more and more offices, workshops, and stores. Then there are the variétés, theaters, and dance clubs,

NIGHTLIFE Differential arc lamp, 1878, first implemented to light the Berlin Kaisergalerie, 1879



which are being covered with roofs and moving from the edge of the city into the center. Now that gas lights are no longer polluting the air, dancing is winterproof. Night clubs and revue theaters are springing up left and right. Berlin is celebrating itself and its new urban entertainment and city culture. Getting home to the residential areas on the edge of town is soon possible thanks to the electric streetcar or subway.

THE HOUR OF THE CITY SLICKERS

It is a new urban life, and with it comes changes in art, fashion, music, and entertainment. The city slicker is born! The nocturnal amusements of the big city become amusements for everyone. The wondrous thing about electric light is that it can also be used

by private citizens the same way as its predecessor, the gas light. All of a sudden, even garden parties can be lit, which Werner demonstrates personally with an idea that might well be good enough to win a prize for successful public relations today. On July 5, 1879, he proudly writes to his brother Carl: *Yesterday we tested out the lights in my garden in Charlottenburg for tonight (the garden party). The 12 globes with new lamps were placed up in the trees, and the effect was magnificent! [...] A new standard has been set with the new lamps and the alternating current machines, and now we will see the beginning of the great development of electric light. This ensures good patenting, particularly in America. Several Americans are already looking to acquire railways and electric light from us!*³⁵

LIGHT! NO SOOT, NO POISON!

While the production of light from electric energy is slowly taking shape, people are speaking of the «electric apotheosis» — humans seem just shy of reaching Mount Olympus. Even if the gas light provides a great deal of convenience, it comes at a price, especially when used indoors. Gas lighting, especially in theaters and other public spaces, consumes a lot of oxygen and quickly heats the air. Theater guests complain of headaches, and the air quality is often unbearable. In addition, burning gas releases small amounts of ammonia and sulfur. This makes short work of ceiling decorations, paintings, and other interior furnishings.

Nevertheless, gas lighting has the enormous advantage that it is «divisible.» Gas lines can be laid in cities, which can be fed from gas plants and split as often as needed at the other end. Even private apartments can have as many connections as necessary. The amount of light can be regulated as well, simply by adjusting the flame higher or lower. Electricity, however, is much more difficult to control, at least in the beginning.

BRIGHT AS DAY ON THE CORNER OF FRIEDRICHSTRASSE

In 1878, the young engineer and chief designer at Siemens & Halske, Friedrich von Hefner-Alteneck, makes significant improvements to arc lighting. At that point, Werner is already in negotiations with the founder of the Société Générale d'Électricité, who holds the patent for the arc light and is marketing electric light in certain parts of France. One year later, the Kaisergalerie in Berlin is illuminated brightly in electric light from differential arc lamps made by Siemens & Halske. It's a sensation. Arc lighting is the perfect lighting for large, public places, but the necessary current isn't yet available from a power plant. They do not yet exist. Every lighting project requires its own miracle machine — a generator — to be specially installed.

But soon, Edison's light bulb brings about big changes. Electric lighting is not only reliable, but, like gas lighting, it is also divisible. The demand for electricity skyrockets.

SIEMENS ELECTRICAL ENGINEERING

Werner, who sets the pace of this development, coins a term that, even to this day, is closely associated with the name Siemens: electrical engineering. In 1879, he writes a letter to the postmaster general Heinrich von Stephan: *Your Excellency, I beg to submit for your favorable consideration the enclosed «Draft Statute for a Deutscher Verein für Elektrotechnik.» [...] I therefore beg to suggest that your Excellency assume the patronage of a German association embracing the whole field of electrical engineering. Such an association has become essential and could be of the greatest benefit. In addition to telegraphy, the development of which has already been directed into more settled paths and which represents the aristocratic, conservative element of electrical engineering, we see everywhere a wild rush, a restless striving, to*

gain for electricity an important place in the old branches of industry and to base new ones on it. Especially since dynamo-electric machines have made possible the generation of cheap and powerful electric currents by mechanical power, the future field for electricity is practically unlimited. I need only mention electric light, power transmission by electricity and electrical copper refineries on a large scale, which have already paved the way. [...] All these activities have so far lacked a properly constituted focal point. I am convinced that all other civilized countries will soon follow Germany's lead in the establishment of electrotechnical societies, but it will always be of great value to have been first in the field! In no country is there more fruitful soil for the development of electrical engineering than in Germany for in no other country is knowledge of the natural sciences so widespread.³⁶ The standing and localization of electrical engineering is part of it, and the rest is the groundbreaking innovation. Werner and Heinrich von Stephan are among the founders of the Elektrotechnischer Verein (the German engineering society), and Werner becomes its founding president.

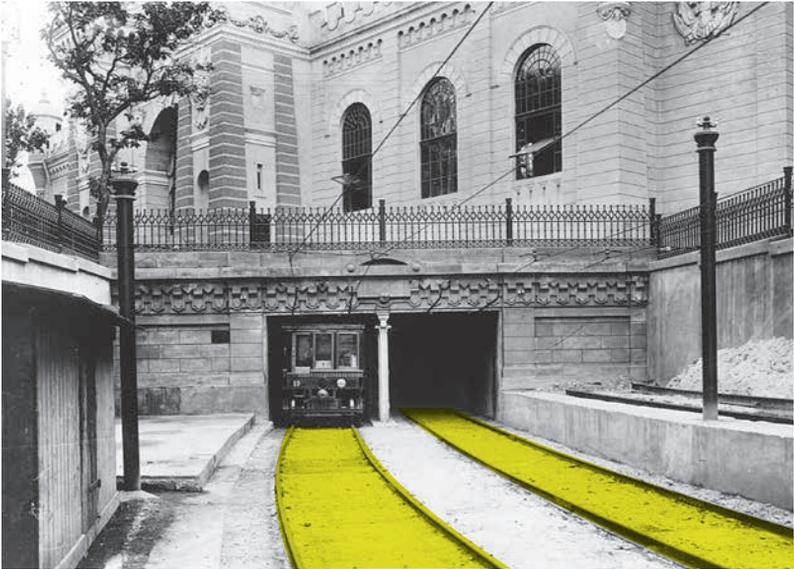
THE DYNAMO MACHINE TAKES OFF

A central electricity station is needed urgently. Models for what such a station might look like are based on water and gas works, which are also relatively new. The first electric power centers come into operation in 1882, allowing current to be carried in lines and different branches. Founded by the German Edison Association, the «Städtische Elektrizitäts-Werke» is ready in Berlin in 1884. Under the name AEG, the Association will later become a major competitor for Siemens & Halske. Germany's first electric utility begins its work in the middle of Berlin on the Gendarmenmarkt. It is the hour of triumph for Werner's dynamo machine, as well as the generator's counterpart based on the same principle: the electric motor, which converts electrical energy into mechanical energy.

When Werner and Johann Georg Halske start their joint venture in 1847, Berlin has just over 400,000 residents. Thirty years later, Berlin's population will hit a million. Shortly after Werner's death, another 30 years later, it tops two million. In 1925, Berlin is the third-biggest city in the world, behind only London and New York.

PATIENCE

Light is the first thing to be electrified, followed by public transportation, with electric trams and elevated or underground railways — an idea Werner knows inside and out. Even when potential clients, politicians, and administrators refuse to be convinced, even when there are no initial investors that believe in the idea, Werner doesn't let himself be deterred. Like many outstanding entrepreneurs, Werner is defined by his patience. Sometimes the timing just isn't right, and others can't see what



THE FIRST SUBWAY IN EUROPE By 1903, 134 cities will have invested in public transportation.

has long been clear to someone like Werner. A pioneer can either let doubt creep in, or endure rejection and ignorance, and carry on anyway. In 1896, the first underground railway on the European continent finally begins operating—in Budapest. It was planned by Werner for Berlin.

ELECTRIFYING THE TRAM

It takes nearly a decade for the wheels of the electric tram to be literally set in motion. The milestone is brought about by another innovation. The breakthrough comes after Siemens engineer Walter Reichel invents the bow collector in 1889 and the electric tram proves to be safe. From that point on, investments in public transportation increase sharply. By 1891, there are electric trams in three cities, and by 1896, there are 42 trams covering a total distance of 582 kilometers. By 1903, this has grown to 3,692 kilometers in 134 cities. Werner is more fascinated by the electric elevated railways, which are faster.



JOB SECURITY A workshop manager at Siemens & Halske earns 700 thaler per year, while a laborer earns about 300.

A SERVANT FULFILLING A DUTY...

... and above all, a businessman with composure. Pension funds, regulated working hours, profit sharing — Werner takes social responsibility prior to Bismarck.

For years, Werner and his brothers operate in a market that is subject to fluctuations and contains just a few potential customers. How is it possible to create a functional company with so many dependent employees? The answer: with internationalization and diversification. William, for example, develops a water

meter and has it patented in England. He has the water meter manufactured by Siemens Brothers, even though it only amounts to a paltry gain. The devices, however, provide the necessary «background noise,» meaning during periods where few contracts are coming in, the skilled workers can be kept on board.

This does more than provide a high degree of job security for the employees. Word spreads about companies which are prone to «hire and fire» and which value continuity. Siemens Brothers knew that the acquired skills and qualifications of their workers, along with a sense of belonging, create value for a company, and not just in England. *I now feel like I am simply a servant fulfilling his duties in my business. One's own personality must take a step back when considering all that is depending on forward progress,* Werner writes to his wife Mathilde in 1855.³⁷

WE ARE ENGINEERS

The Siemens brothers' stance on social issues can be seen in the approach they take to their business. It is shaped by the Protestant ethic, which according to Max Weber, forms the «spirit of capitalism.» It characterizes the Siemens brothers in every way: Disciplined work, ambitious talent, careful handling of capital — and a clear definition of what one does and does not want to be: *We are engineers and manufacturers and want to make a good living from installation and upkeep. We can leave the commercial capital speculation to others,* Werner writes to his brother William in 1867.³⁸ Two years earlier, Werner had clearly formulated his skepticism: *We have only had missteps when it came to commercial endeavors. We are not merchants, and are inferior in that regard to every average fat cat.*³⁹

FAMILY FIRST

For Werner, business practice always means acting with and within the family. Innovations are developed collaboratively with his brothers, and the important roles in the company are entrusted to family members, particularly when it comes to far-flung posts abroad. Always the family man, Werner's family remains a driving force throughout his entire life, representing a strong leitmotif for Werner. He writes to his brother Carl in December, 1887: **Certainly I have pursued profit and wealth, but far less for the simple enjoyment of it, and more as a means to carry out other plans and to pursue other ventures. By succeeding in these, I gain recognition for the correctness of my actions and the usefulness of my work. [...] The business as a monetary object comes second to me. For me it is much more like an empire that I created and want to leave intact to my children so they can carry on.**⁴⁰

The broad perspective with regard to developing products is reflected in how Werner shapes his business, and in the treatment of his employees. **The business issue must be handled objectively and with an eye on the future. [...] I wish for the continuation of**

**AIMING FOR
QUALITY**

In 1982 the Harvard professor John P. Kotter coined a term that is almost over-used these days: leadership.

Even at the time, Kotter made it clear that there is, in his view, a difference between managers and leaders. Managers are more like administrators, whereas leaders are visionaries. Leadership, he said, is the ability to inspire and motivate through vision. However, Kotter also stated that there is nothing mysterious about leadership. Developing good business direction isn't «magic,» he said. It's «a tough, sometimes exhausting process of gathering and analyzing information.» Nor must visions be «brilliantly



current operations under viable conditions, and hope that those who have linked their fate to our business and faithfully served us are able to find recognition and a secure livelihood. Everything else is of secondary importance to me, most of all my personal comfort!⁴²

THE PRINCIPLE OF PROFIT SHARING

The bigger a company gets, the bigger its moral obligation to its employees. On June 16, 1868, Werner writes to his brother Carl: *The money I earned would burn like a red-hot iron in my hand, if I did not share the expected proportion with those who loyally helped. It would not be wise of us to let them go empty-handed in times of great, new ventures.*⁴³

To retain and motivate his employees, Siemens develops a system for profit sharing early on, and from 1855, staff receive regular bonus payments. Later, when the company begins pursuing serial manufacturing of its products, Siemens introduces piecework wages, allowing factory workers to earn considerably more. In 1872, the same year Siemens sets up a pension fund, working hours

innovative;» in fact, he said, some of the best are not. In most cases a sober, pragmatic approach is best – which is also how Werner ran his company. What counts is performance, not the speeches and drumrolls. In January, 1876, Werner writes in a letter to Rau, a Siemens representative in Brussels: *The one who supplies the best quality is the one who stays on top, and I always prefer to advertise with results rather than words.*⁴¹ Werner is one of the first to embody this modern, European-style of businessman – someone

who applies scientific methods and always asks himself: How do I make an invention suitable for mass production? His inherent drive was what made him exceptional – his ideas for turning his discoveries and inventions into products. Products that revolutionized entire markets.

are reduced to nine hours per day and 54 hours per week. Anyone who is employed by Siemens & Halske for 30 years is entitled to benefits upon retirement, usually amounting to two-thirds of active wage. The Pension, Widows' and Orphans' Fund puts Siemens several years ahead of Bismarck's social legislation, which is only implemented in the German Empire in the 1880s. Werner does not see himself as any kind of social patron, hoping to win influence through great kindness. His approach is pragmatic: everyone involved in the company depends on the others, and each person deserves to be treated with respect.

A letter to his brother William makes it clear: *We cannot deny the basic principle of our business, which is built largely on solidity: we will not dismiss anyone and make him destitute, if he always carried out his duty.*⁴⁴

REPLACEABLE IN AN EMERGENCY

His sober, pragmatic view on the demands of a company dictates his stance in this regard as well: *I have always found it to be the biggest waste to not include those who are involved in the management of a business in the outcome. [...] At large and particularly branched businesses, where you can't supervise everything and some things must be specially delegated, you must divert a significant portion of the gains to these delegates. That is a basic rule for operating a larger business! A completely different spirit has taken over Berlin since all foremen began receiving an annual bonus, based on the profits of that workshop. We work more, cheaper, and better, and still have trouble handling the work. Being well-organized is better than making double the profit share! Please, first and foremost, keep the distant future in mind at all times, as that is what matters most. [...] We will all grow older; fate has shown us over the years how frail we are. We must therefore arrange things in such a way that we can be replaced*

in an emergency! Otherwise, when we pass away, everything will come crashing down, and we will have prepared things poorly for our descendants.⁴⁵

Werner wants his employees to identify with the company. He writes to his brother Carl a few years prior: *If people aren't speaking of «we» when it comes to business matters, and don't have the opportunity to feel a part of the acclaims and concerns of the business, we cannot expect or demand loyalty, in grim times as well. My practice has always been to treat all industrious persons as if they were like me when it comes to private matters. In business matters that pertain to them, I approach and speak to them as if their affairs were the same as mine [...]; this has always proven to be quite useful.*⁴⁶

To only see the cost of his employees, and to make demands of them without giving much in return, goes against Werner's view of what it means to be a responsible entrepreneur. To George Bolton, head of the copper mine in Kedabeg, south of Tbilisi, Werner writes: *As soon as a manager focuses solely on his power, and demands, above all, obedience and respect from them, rather than treating them humanely and considerately as employees and colleagues, and encouraging their goodwill and inspiring their ambition, sooner or later the facility will perish.*⁴⁷



BEAR HUNTING IN THE CAUCASUS Werner always finds time during his travels to learn about the culture of the countries he visits.

ALWAYS ON THE MOVE

Werner's success in business was due in large part to one thing: travel. He always heads to where he senses a good business opportunity.

Traveling creates new contacts and forms the basis for an entrepreneur to expand to new areas. There are businesspeople who remain in one place, in their factories and stores, and say to themselves «I'll wait for the customers to come.» Then there are those who ask, «why wait? I'll go where potential customers are.» Werner has an infallible instinct for identifying regions where he will need to travel to lay the groundwork for new

business. His travels in 1858 alone show how much energy he applies toward being present in places that are or could be of importance to him.

First, in January, he spends ten days with Halske in Vienna. In mid-May, he takes a four-week spa treatment in Karlsbad, and from mid-July he spends several weeks in St. Petersburg. From the middle of August to the beginning of September he is in London, after that two weeks in Paris, and so on and so forth. Travel is still very difficult at this time, but he still writes positively to his brother William after the short trip to Vienna: *I am quite satisfied with this trip. We were courteously received by the ministers, telegraph directors, etc., and the prospects there seem to be brilliant. We will provisionally establish a branch in Vienna, and then see where our final focus will lie. Intelligence and capital are still highly-valued in Austria.*⁴⁸

PARIS — THE DULL NEST

Paris, in contrast, isn't such a hit. The silver lining: *Everything here reminds me of my honeymoon, giving otherwise hated Paris the pleasant tint of memory!*⁴⁹ Werner writes to Mathilde, but he does not like the city. *A dull nest, is Paris! You run and walk all day long and don't get anywhere! It makes my stay here quite tense. The French are always full of smooth, beautiful expressions, but there is nothing behind them. I prefer England.*⁵⁰

It is precisely these longer business trips, in particular the three endeavors of several months each to St. Petersburg and Riga in Russia from 1852, that pave the way for new business. His 1859 trip to Egypt, during which he is tasked by the English government to lay the Red Sea cable, also provides Werner with his first impressions of the Arab world. Longer trips come in 1865 and 1868 to the Caucasus, also business-related, which include visits

to Tbilisi and Odessa. Keeping in mind that there are no airplanes or high-speed trains, the trips are quite arduous and costly. The preferred means of transport are horse-drawn carriages, steam ships, and — with a lot of luck — trains.

THE BEAR'S SCORNFUL LOOK

In 1890, Werner makes another trip to the Caucasus, this time with his second wife Antonie and daughter Hertha. Their route takes them from Sebastopol to Jalta, Tbilisi, Baku, Kedabeg, and then to Moscow and St. Petersburg. He writes to his sons of the trip: *You have probably already heard that we took part in a great bear hunt in Kedabeg, and shot at five bears right in the first effort near Kalakent, unfortunately without success. I shot at one large female bear, which then plodded on quite leisurely past me with her two cubs. She gave me a scornful look. Carl thought he had shot his bears clean through, but he was in too much of a hurry. Dr. Hammacher got a little fright when a large bear that Hubrich had shot started toward him. It turned away, however, and paid no mind to Hammacher's shot!*⁵¹

SHAH MANIA

In many places, fascination with the Orient became a spectacle and source of entertainment. A visit to Berlin by the Shah of Persia resulted in a number of exceptional circumstances.

«Who knows himself and others well / No longer may ignore: / Orient and Occident dwell / Separately no more,» Goethe wrote in his «West-Eastern Divan» of 1819. The German writer believed that there was an «almost elemental connection with the East» — and above all, of course, to Persia, the land of myth and legend. In a way, this was also a reflection of the mood in the 19th century. This mixture of fascination and disconcertment persisted well beyond Goethe's lifetime. It was particularly apparent in 1873, during the Shah's grand visit to

EXPAT IN PERSIA

Since 1860, Werner's brother Walter is the head of the Siemens & Halske branch in Tbilisi, where he handles all dealings with the Persian government regarding the expansion of the Indo-European telegraph line. This project will bring them great prestige, and Walter is to close the deal in Tehran. For this, he must precisely assess how the Siemens brothers can become successful in Tehran, which includes outdoing the competition. Werner writes to his brother William: *Above all, you should acquire precise knowledge of all intentions and plans of the English government relating to the Turkish-Persian lines and try to prevent the Persians from getting the idea of profiting in the north by agreeing to give up the contractual price difference of the submarine dispatch funding!*⁵²

Berlin. The Persian ruler, Naser al-Din Shah, was welcomed by Kaiser Wilhelm I and the Chancellor of the Reich, Otto von Bismarck, and driven around Berlin with them in an open-topped car. It was quite a spectacle. The capital of the German Empire had erupted in veritable Shah mania. Flags hung from the windows, and people climbed to the tops of trees, brewers' drays, or houses just to catch a glimpse of the Shah and the Kaiser. They cheered, celebrated, and applauded. A huge merchandising effort was already underway before the visit began. There

were Shah biographies, Shah poems, Shah pictures; Berlin restaurants offered «cutlets à la Shah;» the barber could give you a «Shah parting;» «Shah bouquets» were to be had at the florist's, and «Shah cigars» at the tobacconist's. People celebrated themselves, as well as the visit, with a Berliner twinkle in their eye.



GRAND SEIGNEUR, 1892

GOING PUBLIC

How the company remains a success beyond Werner's time — and continues to grow. The start of an ongoing global success story.

He paves the way to modernity, electrifies cities, creates new sources of energy, and has a bustling, open mind for anything new — and yet Werner remains quite conservative in one regard: the legal form of his company. He does not want any changes, and he has his doubts that his sons can shoulder the responsibility if he were

to retire. He writes to his brother Carl on December 16, 1888: Business is becoming more and more varied, and I often wonder if my sons will always be able to keep their heads above water! During these trying times, it does not seem right that I would formally resign — it will have to happen at some point, though, and it is better to give my sons a sense of the full responsibility that they will have to carry and strengthen at the same time. [...] I will take stock, and surely will become more outwardly active after my formal resignation. I don't have much more to offer to the business at this point, as I am becoming more and more unfamiliar with it all and as an old autocrat, I am having trouble coming to terms with the new necessary legal forms.⁵³ Werner resists every change of the company's legal form right up until his death.

THE FUTURE BEGINS

His brothers had previously already decided on a new legal form for the business. Thanks to the efforts of William, in 1881, the London business is turned into a public company, and in 1886, another public company — the «Petersburger Gesellschaft für elektrische Beleuchtung» lighting authority — is also established under Siemens management. What Werner does allow, on January 1, 1890, is the conversion of Siemens & Halske into a limited partnership that includes Carl Siemens and Werner's sons Arnold and Wilhelm as partners. Werner remains involved. The transition to a public company, Siemens & Halske AG, takes place in 1897 — around five years after Werner's death.

The legal form of his business may not have endured, but his inventions, his outstanding entrepreneurial talent, and his words have: *If, after our deaths, someone wants to write a history of the Siemens brothers and their rise, he will find good material in the letters.*⁵⁴

RUSSIAN OVEN

Great relationships

There's more than just a strong woman behind every successful man. For Werner, there are two — plus seven brothers, two sisters, three sons, and three daughters.

Throughout his life, Werner remains in close contact with his family by writing letters. He uses the mail to share heartfelt feelings, report on successes and setbacks, and conduct family business.



MATHILDE SIEMENS, née Drumann, with her son Arnold, circa 1854

THE BEACON OF MY LIFE

Mathilde Drumann is the wife and advisor of the ardent entrepreneur. She loves her «Russian oven.» In his letters, Werner even calls her a «dear gadfly.»

It is an adventurous but tiresome and endlessly long trip. The stagecoach is three hours late. The replacement horses from the Prussian Post are no good, and the trip will only get worse with the Russian Post in an open wagon with no springs. The passengers spend most of the time **bouncing between the sky and the luggage**, as Werner later writes, literally riding over sticks and stones. Sleep is out of the question, and the bumpy ride causes the worst of headaches. He arrives in Riga completely exhausted, and after finally sleeping again, sends his regards to his fiancée Mathilde Drumann first thing in the morning on January 20, 1852: **After being shaken from its joints, my brain is able to think and feel again with a night of rest. My first task, then, is to write you, my dear girl, and wish you a kind good morning! I must also thank you for the favor you provided me in Russia's bumpy corridors. [...] you came, my dear child, and helped me. I laid my head on your chest and slept quietly for an hour!** He describes his pleasant dream further: **I consider this dream a good omen. Life is like a journey in Russia. Will I always find a safe haven in your warm heart, where I can forget the pain of the blows I've received, and start anew against my unrelenting internal and external struggles?**¹

A DEAR GADFLY IN THE NEST

Almost immediately after his engagement to Mathilde Drumann on January 11, 1852, Werner continues to struggle with a number of problems. He spends January to May, 1852, in Russia — specifically in Riga and St. Petersburg. It is his first trip to Russia, where there is business to be done and new markets to be conquered. In August of the same year, he takes to the road again to organize the installation of a telegraph link between Riga and the port of Bolderaja — his first contract in the Russian Empire. He returns to Berlin in mid-September, and the wedding is finally held on October 1, 1852. Even then, there is little time for Mathilde and Werner to spend with each other. A few months later, Werner

heads east again. In the early stages of their marriage, the couple is quite often separated by long distances. Their only option is to gradually get acquainted through regular and close correspondence.

In a letter from February 4, 1852, Werner asks Mathilde to write him as often as possible during his extended trip, because: *In addition to the fact that you would bring me joy by doing so, it is important for our future that we [...] share our thoughts and views in a lively correspondence.* In the same letter from St. Petersburg, a city of *enormity in all dimensions, full of waste and splendor*, he expresses a deep hope. *I'm always healthy while traveling and ill when I'm at home. Hopefully the latter condition will change, now that I have a dear gadfly in the nest who relieves me of some of my constant grumbling and connects me back to life.*² Seen in that way, Mathilde really will trouble him as a «gadfly» would. At the quite advanced age of 36, at least back then, Werner lives with a woman for the first time, ending his bachelor existence and the days of sharing a roof with his brothers.

LONG-LASTING WARMTH

*You see, age and certain life concerns have made me a bit stodgy. You can compare me, and not be mistaken, to a clunky Russian oven: It takes a long time and a lot of firing, as I painfully feel just now, but then it stays warm for the entire day. Laugh at the unsightly comparison, but it's true.*³ Unsightly or not, the image is fitting for Werner: It takes a while for him to warm up, but once he reaches operating temperature, he stays there — just like a classic Russian oven. Made of fired bricks, the oven's unique construction provides optimal distribution and storage of heat. However, this can only be achieved by tediously burning lots of wood. It takes time, but the heat eventually penetrates through and through.

Mathilde picks up the metaphor, understanding exactly what he means: «I am quite happy with my old Russian oven and I wouldn't trade it for any other in the world, not even one that flames and smokes better. I set my heart on it when it seemed very cold and void of emotion, when there wasn't even the faintest wisp of smoke that would tell me if a hidden spark was glowing or not. Now I am happy to wait, until it's heated through!»⁴



HAND IN HAND
Werner and Mathilde, 1852

She is the love of his life, and he confides in her in his letters— but we can assume it doesn't end there. Werner faces many personal struggles, the sadness and weariness that live inside and often weigh down on him. His strength comes not only from his visions and grand ideas: alongside the close and enduring connection to his brothers, it is particularly this emotional and intellectual back and forth with Mathilde that helps him find new ways of dealing with problems.

JOINED IN PAIN

Werner Siemens is born on December 13, 1816, in Lenthe near Hanover. He is the second-oldest son of Christian Ferdinand Siemens and his wife, Eleonore. The couple had a total of 14 children, 11 of which reached adulthood: nine boys and two girls. The children's father spent a few semesters studying agriculture in Göttingen, but later attempts in the agricultural products business proved unsuccessful. Although the family comes from a middle-class background, the agriculture business means they live modestly and are often confronted with harsh financial realities. A carefree childhood is simply not in the cards. Werner's father is ambitious, but his apparent lack of business acumen stands in the way of true success. The family's **beloved mother** provides stability, but also likely suffers under the difficult living conditions. The situation means Werner begins shouldering responsibility early on, as sensibility and earnestness are demanded of him at a young age. He writes Mathilde of his memories from that time in March, 1852: **My youth, in particular, was bitter, starting in childhood. I felt all too well the worries of my beloved parents. The resulting woes in our home and the sorrows of my mother, beloved to me above all else, soon smothered the usual carefree cheerfulness of youth that I might have had at that age, and my schoolmates mocked my philistine earnestness.** He tells Mathilde of the promise he made to his mother, shortly before her death, to look after his younger siblings. Mathilde lost her mother at a young age, too — a sad experience that connects her with Werner. Mathilde's mother died suddenly and completely unexpectedly while she and Mathilde were visiting Berlin in 1845. Werner, a cousin to Mathilde's next of kin, takes care of all the funeral arrangements and provides emotional support for Mathilde. **We found each other in the midst of misfortune and deep sorrow,** he writes in the same letter, **and faithfully waited for the hour when our path would be led out**

of the thorny hours of our lives. Now we've moved to brighter heights, and I hope we'll be repaid for a gloomy youth with a shining life ahead.⁵

COZY OR ADVENTUROUS?

Werner leaves it to Mathilde to decide if the next **shining** phase of his life was that of a **cozy family man**, who runs a **leisurely manufacturing business without risk or glory**, or that of an adventurer, who chases risks to reach **the highest prizes**. He has what it takes for both roles. She knows him quite well, making her decision quite clear. Werner may not be able to precisely predict what changes will come with time, but he knows they will be ground-breaking. He isn't the only one to know that he'll play a decisive role in shaping this transformation into modernity — Mathilde recognizes it, too.

His own financial situation is at that time, in the first half of 1852, rather precarious, and he is far from the peak of his successful career: His company's main business partner, the Prussian state, withdrew their contracts, leaving his scientific reputation in tatters. He hopes to land new contracts in Russia, but it is little more than hope at the time. His pillar of tranquility, Mathilde, is of great help to him, providing him with emotional support during the grueling hunt for business opportunities. «My dear Werner, I spend so much time talking of myself that I have not even thanked you for your last two lovely letters. They bring me closer to your business life — a lively and interesting one! I look to you from my quiet, small corner and see a very different world, where everything is foreign to me. Even you come across as a completely different person, with whom I have nothing in common at all. Always write me very, very much of this world, so I can become familiar with it as well. I will, of course, have to relinquish a good part of you, your thoughts and

feelings, to this realm, but you must bring me to a level to where I can at least follow you in spirit. When you have completed your business in Petersburg, you must clearly tell me exactly what it is you were able to negotiate and achieve there. So far, I have just a vague notion of what that is, and I am sometimes ashamed that I am unable to explain it to others. [...] Please, my love, assume I know nothing before you begin and don't tire of explaining everything to your Tildchen!»⁶



WHICHEVER PATH WE PURSUE ...

In future, it will ultimately depend on you, my dear Tildchen, which path we pursue: whether we run a leisurely manufacturing business without risk or glory and content ourselves with this good, reliable daily bread, or whether we strive tirelessly on and reach for the highest prizes! I have in me material sufficient for both the cozy family man and the restless, tireless adventurer – it is in your hands whether you raise up one or the other natures that struggle within me for mastery, and entirely suppress the other, or maintain them both in proper equilibrium!⁷

LATE BLOOMER

Werner normally occupies the role of leader, motivator, and authority figure — the one who leads the family and keeps it together. With Mathilde, though, he can show vulnerability and doubt. There is always **kind-hearted**, **open**, and **wise** Mathilde, he tells his brothers in his usual straightforward manner when discussing important matters. He wants her with him always and



... OUR LIFE TOGETHER SHOULD BE A SHARED ONE

Your factory seems to me to be an excellent source of the stuff of earthly happiness, and as such is certainly deserving of your care and devotion in the highest degree; but to fill your thoughts and your life with it entirely and forever, like that of so many hundreds of others — with the best will in the world — you are most unlikely to succeed in this. I would far, far rather see you frequently exhaust yourself or be mistaken in the struggle to achieve a goal that is worthy of you, or — most likely — be frequently whisked away from me than fold your wings and rest upon your laurels.⁸

everywhere: Send a picture of yourself to Petersburg, a small, easily-transportable miniature [...]. I have a mischievous and insidious mind that constantly changes the image of my beloved in my memory, sometimes depicting it one way, and then another. With your picture, give me a talisman to protect against my biggest enemy — myself.⁹

After his engagement, he writes — with admittedly less elegance — to his brother William: My bride is not a particular beauty, but that is a secondary matter. I am convinced I will live satisfied and happy with her, and that is enough. Mathilde is his calming influence. She lets him be, strengthens him, and shows wisdom and understanding. I believe my bride, upon learning her closer acquaintance, will please you all. She is a kind-hearted girl, open and sincere, generous and wise — as one can only expect to hear from her fiancée, you'll surely say! But I think my judgment is mostly unclouded by blind emotion. The years where emotion ruled the day are gone for both of us — we're part of the older generation now, after all!¹⁰ At 36, Werner is indeed among the «late bloomers» of that time when it comes to starting a family, and, as an older man, it goes without saying that the search for a partner was quite a rational undertaking.

GLIMPING A MELANCHOLY SOUL

The glimpse of his soul Werner affords to his fiancée goes deep. He speaks of a bout of dissatisfaction with himself and self-torment, and of his old nuisances, of which I always hoped to be rid of forever. He speaks of his self-doubt: I like nothing of what I do and achieve. I always see myself as trite and foolish. I cannot imagine that you could really love me if you were to rightly and thoroughly know me! He is also ready with causes and cures for his cheerlessness: These sudden bouts of melancholy, which come up now and then to my annoyance, are ordinary companions of

old bachelors. I therefore want to lend my trust only to my doctor — you — and attempt until then to muddle along.¹¹

Mathilde responds to his grief not only with love, but also with clever finesse. «If you were here now and could express your bleak thoughts in words — instead of carrying them with you in gloomy brooding — surely, that would come first in banishing them!» She adds: «That is what love is for, to throw oneself — flaws and all — trustingly into its embrace. Certainly, my Werner, I don't love you simply because your good qualities deserve it, but because my entire being is at ease in your presence, because I know one thing, and that it is without you, there would be no peace, no satisfaction, for me.»¹²

TEN TIMES THE INTELLIGENCE TO GET IT WRONG

Mathilde also knows when things go wrong. Werner tells her of setbacks, and openly laments his mistakes and wrong decisions. She responds with sympathy and tact, and above all, loyalty: «Perhaps temporary disappointments and mistakes are needed to protect the mind from slackness and complacency, which are the death of all bustling activity. [...] rejoice in your strength, that after such a blow, you are able to feel as fresh and robust and capable as before. Making a mistake requires ten times the intelligence than accidentally happening upon what's right, don't you think?»¹³ She gives no thought to the idea of settling down, either. «Given the choice between leading a quiet, cozy domestic life with you, or leaving you to your usual restless struggles and aspirations, I can tell you, without hesitation, that I could not possibly imagine you as a factory owner resting on your laurels quietly attending to yourself and your wife.» She knows Werner must implement his vision. He simply cannot do any differently. A placid, orderly life — «that would really be a pity for you.»¹⁴

WEDDING

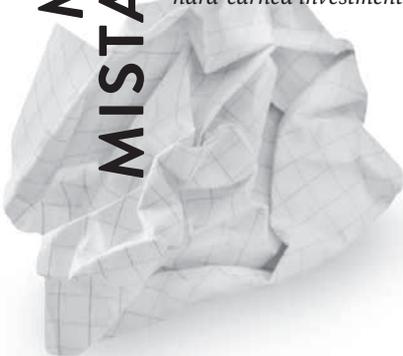
Werner and Mathilde marry in October, 1852. At the time of their engagement back in January, it was clear they wanted to marry as soon as possible, but the date was continually pushed back due to Werner's new business in Russia.

Werner is on business trips for a total of seven months during the first two years of their marriage, and can often only follow family events from afar. He is there for the birth of his first son Arnold in 1853, but when his second son Wilhelm is born, he is again away in Russia. From there, he writes in July, 1855: *Tears of gratitude and joy have quickly driven away the last remnants of fatigue, but I was still unable to fully enjoy the moment. It seems so wrong to know that you're alone, without, at the very least, my comfort and shelter at your bedside. [...] and our new little creature — what does he look like, how is he doing? A strong fellow! Hopefully healthy, and with God's help, a source of long-lasting joy and hope for us one day!*¹⁵

MAKE MISTAKES!

Looking both back and to the future: The error culture is not an invention of the internet age. For Werner, mistakes were a hard-earned investment.

«Ten times more intelligence is required to make mistakes,» writes Mathilde Siemens, encouraging her husband Werner to keep on going, time and again, in spite of everything — and to tolerate mistakes made along the way. This topic is the subject of much discussion in businesses, even today. What is our attitude to error? Is there such a thing as an error culture? Because it is apparent that failure is an inevitable part of tackling something, and that makes it an intrinsic element of success. Even Werner Siemens didn't always — or not immediately — have



In keeping with the times, a strict «division of labor» prevails in the Siemens marriage. Mathilde is at home, taking care of the children, the housekeeping, and the comforts of home. Werner is on the move and taking over the world. From his travels, he sends letters — not run-of-the-mill reports, but writings with a purpose, for nothing is **more boring and off-putting than a letter drafted with visible deliberation. Such a letter is automatically received as a diplomatic document, where more must be read between the lines than in the lines themselves. [...] I have become such an eccentric that I can't really feel at home and comfortable anywhere until I get a clear overview of everything. Only then does the ice that envelopes us in the cold world begin to thaw.**¹⁷ Only then can genuine words be penned to his wife and family.

THE SINGLE DARK SPOT

Now and then, Werner even takes a break. Once a year, he returns to Bad Kissingen, and later Karlsbad or Bad Reichenhall, to recuperate and take part in a spa treatment that involves drinking

the perfect solution. For him, too, it was often a case of slowly getting to grips with something, as for example with insulating telegraph cables, or the very dangerous work of transmitting current to electric trains. Very little was perfect right from the start: many things developed only through the analysis of mistakes — and thus it became clear to Werner, too, that mistakes are part of the process, and can even be important for an entrepreneur's development. They may be painful, but mistakes can indeed have a positive outcome. Mistakes are often the starting point

for innovation. It is Mathilde who highlights this connection — not upbraiding her husband, not blaming him, and certainly not lamenting the failures. The worst that can happen is that a course of action turns out to be wrong, and another path must be found and taken to reach the goal after all. Often enough Werner did have to find new paths — and then made further mistakes. He summarizes this principle succinctly, as follows: **You must pay dearly to learn new things.**¹⁶

lots of liquids. When his wife inquires about the spa, he refers to his response from previous visits. **You want to know how I spent my day? I could simply point you to my answer to the same question last year, as things are pretty much exactly the same.**

**WORK-
LIFE
BALANCE**

Werner with
Mathilde
and their sons
Wilhelm and Arnold,
circa 1857



Flushed out and rested, Werner sees things clearly again. He also recognizes how difficult it is for him to be idle. **We would both do well to take note of this, dearest. We let our feelings become completely absorbed by our duties, even if out of old habit.** Werner takes sober stock. **We're missing the right balance between work and rest. Tension and release! We allow the future to dominate too much over the present, but that will probably change when our children have grown some and our love for them connects us once again with the joy life can offer.**

That isn't merely the wishful thinking of an overworked businessman. For Werner, there is a deeper meaning. Mathilde is sick. For years, she has carried a lung condition that constantly plagues her health and from which she never completely recovers. Another reason why the desire to enjoy the day to the fullest seems so urgent.

Of course, if you were healthy again, things would be different. Now, we'll surely overcome this as well, my dearest, and will

strive with all our strength to rid our otherwise blessed lives of this single dark spot. The more energetic and prudent action we take to this end will even more abundantly make up for the worry and hardships we've faced when we achieve this happy success.¹⁸

Nine months later, in a letter to his brother Carl, Werner is less hopeful. Dear Brother! [...] Mathilde's now terribly fast-advancing sickness is taking all the peace and joy that I always had in my work when it was reasonably successful. Heaven save you having to watch the slow and pained withering of such a beloved being without being able to help and without being able to grasp even the weakest hope! God give her at least a gentle death.¹⁹

There is no chance of improvement. Mathilde Siemens dies on July 1, 1865.

EVERY END HAS A BEGINNING

Two days after her death, Werner turns to his brother William: Despite her long illness and physical suffering, she was always a firm, clear beacon of my household, the upbringing of my children, and indeed, my entire life. The sense of rightness, truth, and duty was so embodied by her, that I gladly and willingly left the burden of managing the household to her, right until her final days. You can see how abandoned I must feel after this loss, which was admittedly long expected and for her even desired, and the entirely new responsibilities I must now fulfill, and hopefully will fulfill!²⁰ It is a great blow in the life of Werner Siemens. At the same time, he faces the great responsibility of replacing the children's mother — somehow. In July, 1865, he writes to Anna Kossobutzki, a longtime friend of Mathilde: They were difficult times, dear friend, when I struggled at the deathbed of my beloved wife and after her irreparable loss! [...] Now I have found peace and balance again. I

vowed to her on her deathbed that I would raise the children and continue my life in her spirit, and I will keep to that. Strict duty and the restless activity in carrying it out, and caring for those closest to her, were the essential elements of her spirit. It would not do her justice to remain idle in lamenting her loss — it's like she's always calling to me: «Think of your children, your duties!» And that's how it shall be.²¹ Despite his conviction, mourning his wife occupies Werner for some time. I cannot seem to find joy in life, he writes his brother William in April, 1866. I don't know if it is because I am approaching 50, or if it is the effects of the loss of my Mathilde that have made life so uninteresting for me! In all likelihood, it has nothing to do with the landmark birthday but instead with the loss of the most important person in his life. Despite her illness, she was until the end the spiritually-refreshing element

THIS IS NO HUMBBUG!

The incredible medical advances of the 19th century — from Ignaz Semmelweis to Claude Bernard.



As late as the mid-19th century, physician Ignaz Semmelweis was laughed at when he proposed that doctors should wash their hands before leaving the morgue. From the second half of the 18th century onwards, doctors and scientists had been working ever more intensively to systematically investigate the causes of diseases. Nonetheless, from today's perspective, many of the explanations considered at the time to be «proven,» and many of the treatment methods they introduced, seem risky and irrational to us. However, thanks to rapid developments in the natural sciences over the course of the 19th century, medicine was increasingly put on a comprehensive scientific footing, at accelerating speed. Around the year 1900, hospitals like Berlin's Charité were modern, scientific facilities in which pioneering operating methods

of my head and life. I often feel as if I was spiritually laid to rest along with her!²²

In time, Werner emerges from the sadness by fastidiously pursuing an idea that will later prove to be a tremendous success: his discovery of the dynamo-electric principle. *I have had a new idea that will, in all likelihood, succeed and give significant results. [...] This whole thing has great potential for development and can pave the way for a new era in electromagnetism! An apparatus will be ready in a few days. [...] Magnetic electricity will be cheaper as a result and now light, galvanic metallurgy, etc., and even small electromagnetic machines that get their power from large ones, will be possible and useful!*²³

were being developed or medical discoveries made almost annually. In the space of just a few decades, pathogens had been isolated for many diseases that, until then, had been virtually untreatable, such as anthrax, diphtheria, tuberculosis, leprosy, plague or syphilis. The discovery of anesthesia also facilitated advances. Ether and laughing gas were the substances of the moment. Modern anesthesia dates from the year 1846. Werner Siemens had just developed the electric pointer telegraph; and in Boston, the American dentist William Green Morton performed, for the first time, a public operation on a patient under general anesthetic. The head surgeon, John Collins Warren, called out to the audience of experts in attendance, «Gentlemen, this is no humbug!» In Germany, too, doctors and natural scientists were working

on pioneering discoveries and cures. The chemist Justus von Liebig, for instance, developed new analytical methods in organic chemistry, with a focus on food chemistry and metabolism. The physicist and physiologist Hermann von Helmholtz, a close friend of Werner's, invented the ophthalmoscope and the ophthalmometer and investigated the speed of nerve impulses and reflexes. This particularly broadened understanding of the processes of seeing and hearing. Another example is the physiologist Claude Bernard, who made important discoveries about the functions of the pancreas and liver. It was the dawn of modern medicine, which fundamentally influenced and changed people's lives at least as much as the emerging sciences of telegraphy and electricity.



AT THE HEART Werner's office in his house on Berliner Strasse in Charlottenburg

THE WORLD BELONGS TO THE LIVING

Two years later, when the wife of his brother Carl becomes seriously ill, Werner seems to have gotten past his own grief. He encourages his brother to get through such times by staying active, and although Carl prefers to stay with his sick wife, Werner beckons him to work. I won't keep you long, but without your participation, I cannot prepare for Tbilisi and keep the business and household in order. Perhaps I can accompany you back, as I also long to see poor Marie again. [...] Do your utmost to combat your adversary, to faithfully fulfill your duties as long as the strength holds — and leave the rest to be commanded by God — that is the best and most reassuring philosophy. Hold fast to this, as my unforgettable Mathilde did, and I with her.²⁴

Misfortunes are a part of Werner's life, and it is not only Mathilde's death that he faces. Two of his brothers die as well — Hans two years after his wife in 1867, and Walter just a year later. Walter's death also leaves a large void at the company, as he had, until then, organized the construction of the Indo-European telegraph line from Tbilisi. Despite it all, Werner apparently finds a way to overcome even the hardest blows. A year after Marie's death, he writes his mourning brother Carl: *The memory of happy times in the past will no longer be painful, but comforting, even if the pain gains the upper hand now and then. You must take it upon yourself, dear brother, not to allow that. The world belongs to the living, and this departure must not keep us separated from it and the joys it has to offer!*²⁵

SORROW MAKES ME DILIGENT

Nevertheless, Werner faces difficult times without Mathilde. The joyless Christmas he describes to his brother Carl in 1868 is just one particularly sad example. Various maladies surround the family. Despite his young age, Werner's son Arnold develops a serious heart condition, and his old friend William Meyer is dying.

Werner's words to Carl are on the one hand depressing, but, on the other, show his tirelessness.

It was a sad Christmas for me. Arnold is recovering extremely slowly from his dangerous relapse, and he'll likely suffer from this disease for the rest of his life. He has a serious heart condition. Without a fever, he has a pulse of 120 to 130 with even the slightest movement (from the bed to the sofa) as a result of leaky heart valves. There is constant fear that a so-called attack of nerves (obstruction of an artery) could occur. My other children all had colds over Christmas as well. New Year's Eve, which I used as a postponed Christmas, was quite sad without Arnold. Poor Meyer has been between life

and death for weeks now. The poor, afflicted man has the holy fire on top of his other ailments, and it has spread across his entire body. I fear greatly for his life, as he is growing continually weaker. Add to that the death of Marie Siemens' sister a few days before Christmas after much suffering, and you get an idea of our joyless house! But enough of this misery. Sorrow makes me diligent, so business is not suffering. Quite the opposite; things are going rather well. Orders are complete, and the many new constructions are doing very well. I'm now actually reforming the entirety of telegraphy. Mechanical speculation is my opium!²⁶

**WERNER'S SON
ARNOLD** Despite a serious heart condition at an early age, he lives to be 64 years old, circa 1870



AN ELECTRIFYING TOOTHACHE

Technological progress as opium. A greater motivator for Werner may also be the fact that Arnold is soon back on his feet. Up until this time, still very little is known about the human body, and about the causes and developments of diseases. But in the medical field enormous progress is made over the course of the 19th century in diagnosing and treatment — triggered by accelerated developments in science.

In 1844, Werner is already experimenting with electricity to treat his brother Friedrich's toothaches. And thanks to friendly relations with the great scientists of the time, such as Hermann von Helmholtz and Emil Du Bois-Reymond, Werner remains intensely devoted to medical quandaries until late in life — always, of course, under the auspices of a business case. A few months before his death, Werner writes to his brother Carl: *You will have surely read in yesterday's «Nationalzeitung» my article about using boiling water to treat cholera and other infectious diseases. I think this will take hold and everyone will want to have a device to boil water. Perhaps it is worthwhile producing such things in bulk.*²⁷



TOGETHER Werner with his second wife, Antonie, and their two children, Hertha and Carl Friedrich, Sylt

TOMFOOLERY

Werner's sister is constantly trying to set him up with new women. He resists with all his might — until a young woman from the Swabian region of southern Germany enters the picture.

The expression «tomfoolery» is commonly used to describe silly, foolish behavior. A person does something that would be wiser to avoid, as he is bound to make a fool of himself. Werner uses the term as a cheeky beginning to a letter to his cousin, Marie Siemens, in 1869. With perhaps just a half-serious wink of amusement, he confesses to [a bit of tomfoolery](#). He is referring to a new woman, and a second marriage — this time with a significant age difference. [Our tall Swabian has turned me from my conviction never to marry again — as you can see from the included announcement! I hope the twilight of my life will be a little more cheerful with this somewhat reckless step. My fear of getting older is already greatly reduced!](#)²⁸ It tickles him that his distant relative Antonie Siemens — the daughter of Carl Georg Siemens from Hohenheim near Stuttgart — will be his wife. Him, the aging entrepreneur, and her, blossoming with life.

SHE'S TORMENTING ME WITH MARRIAGE SCHEMES

Werner really does resist a new relationship for a long time, especially when it comes to the persistent efforts of a certain relative to find him a new match. The «marriage schemes» of his sister Mathilde wear on his nerves in light of his other priorities. [Despite my clear request to let me be, she torments me to no end with marriage schemes](#), he writes to his brother William in August, 1866. His sister wants to see her brother happy again, but he is mostly concerned with being a good father for his children. [I thought I was able to dispel the notion last year, when I told her I want to live entirely for my children and that I would never agree to give them a stepmother with whom their hearts were not connected, and perhaps never would be connected. The only thing I could even remotely imagine would be to take their nanny, whom they have known since early childhood and with whom there is mutual tenderness and love, and marry her, simply to secure and legalize her position!](#)

He seems to be at a loss and asks his brother to assist. *If you write to her again, tell her to spare me her direct and indirect proposals, because they only achieve the opposite effect of what she wants.* His sister remains determined, but Werner simply does not want to take these first steps and hardly even dares to look at women. *I'm starting to anxiously avoid every unmarried woman, because it goes against the grain of my soul to be the subject of speculation.*²⁹

OVERCOMING SPACE AND TIME

Despite his protests, his resolve is weakened by this woman from Swabia. It takes a few years—much too long in his sister's opinion—but then, suddenly, something changes for him. Antonie penetrates his heart. He writes her in May, 1869, full of fervor, using all manner of technological inventions of the time to describe his emotions: *My dear, sweet bride! Hardly have you left, and I must send you*

RATIONAL LOVE

Huge changes were in store in the 19th century in terms of population, family, and livelihood.



Werner is of a cohort correlated to a very high birth rate. The population of many European countries increased rapidly at the start of the 19th century. One of the main reasons for this was the improvement in the diet of large swathes of the population. Just a generation or two earlier, it was usual for many children to be born, but for many to die in infancy: A quarter did so even before the age of one. One of the main reasons for the population explosion was the introduction of the potato. By 1800, it had gradually established itself as a staple foodstuff: It was easy to grow and could be stored for a long time, meaning there was enough to eat, even in winter. It also provided about three-and-a-half

a word of greeting. It is as if my happiness and hope are rolling away to unreachable distances along with the locomotive. But I want to master this dismal feeling. Steam and electricity shall be my weapons to overcome space and time and create a solid bond between us, which will intertwine our hearts and souls ever closer and stronger, until you are mine alone. Yes, you tall little sorceress, you have with a single stroke, turned this withered old man weighted down with strenuous work and years of sorrow into a fiery, youthful-feeling lover. The new, unfamiliar light of future happiness somewhat blinds my eyes, which are accustomed to the darkness [...] and I am happy to admit that I am nearly ashamed of these youthful feelings, which I cannot resist. [...] I will offer all that is in the strength of an honest, loyal, and deeply affectionate man to make you happy, and your loyal, truthful eye, your warm, kind heart are my assurances, that you will be a faithful, loving wife, and a loving mother to my children!³⁰

times as much sustenance as grain over the same area of cultivation, so more people could eat their fill. The prevailing model of the family was also changing in this age of early industrialization. The «peasant family,» in which everyone lived under one roof and worked together in the fields and on the farm, was becoming less dominant. The labor supply in the newly-created industrial facilities began to replace the family models of agrarian society. Working-class and middle-class families started to emerge. Middle-class families cultivated a domestic idyll and a specific sense of family. People wanted their life together to be pleasant and cozy. The woman looked after house and home;

the man earned the money. In working-class families, the woman also had to work and contribute to their earnings. The «work» of the woman in a middle-class family was to look after the home. Life in peasant and working-class families was hard; laborers, in particular, had to content themselves with the lowest standard of living imaginable. In peasant families, a woman's value was dependent on her dowry and her capacity for work; in middle-class families, it was her family background. The marriage of Werner and Mathilde corresponded to the ideal of «rational love,» and the same was true of the marriage with Antonie.

THE OLD, SMITTEN BOSS

Just a few weeks after sharing his **tomfoolery** with Marie Siemens, Werner marries Antonie Siemens. It is June 13, 1869. Construction on the Indo-European telegraph line from London to Calcutta is in full swing, and business in general seems to occupy his full attention. Shortly before his wedding, he writes his fiancée: **It's a bit alarming for a busy businessman to serve as a groom! More than once I have simply nodded my head in agreement without knowing the facts.** He is also concerned with his image among his employees — the aging boss and a new love! What will they think of him? At the very least, a jest is in order: **You must look quite grim so the youngsters don't laugh at their old, smitten boss who is bungling up their work!** However, the thought doesn't really seem to disturb him. **But what can be done? They are all good to me, and you can see their quiet joy at the new hope and zest for life written on my face.** ³¹

IT'S A BOY!

Along with new hope and a zest for life comes the joy of two more children. Werner's daughter, Hertha, is born on July 30, 1870. His son Carl Friedrich comes on September 5, 1872. Werner is glad that the second offspring of his second marriage is a boy, as he shares with his brother William after the birth: **You will have already learned by telegraph that the alleged degeneration of the Siemens family [...] has taken a turn for the better. For me, the balance has been restored between the genders! The little one — I suppose the last — is a strong and seemingly well-built specimen, weighing 3.5 kilograms with a splendid appetite and healthy lungs, thus leaving nothing to be desired for the time being.**

The proud words of an older father, although he concedes: **I will scarcely experience the triumphs of his life, but I trust that his**



STERN HARMONY

Werner with his second wife
Antonie, 1869

older brothers will, in the tradition of the family, take on a fatherly role when I am no longer able.³²

A LOOMING DISGRACE

Antonie kindles a new flame in Werner, giving him courage and — like Mathilde — a recipient for his thoughts and experiences as an ever-industrious businessman. He writes her of what moves him and of important events, like the time in 1874 when a catastrophe loomed on the horizon. *It is a trying, dire time, full of worry and commotion! [...] when I arrived this morning on my Irish cart in the usual ghastly rain [...] I was met with long faces. There was a defect in the cable, which the ship was trying to recover. After*

midday, it was all over — the cable likely torn. Now Carl will have to fish for it in 10,000 feet of water, and if he doesn't find it soon — as I fear — he'll have to go back to the start, where it is less deep, and start all over again! That will take weeks, and God knows how it will end! Now, I am composed and prepared for anything, but I would have a tough time with such a disgrace. He is referring to laying the transatlantic cable with the ship *Faraday*, which initially goes everything but smooth. As if that isn't enough, there are also other annoyances: Tight boots! No cigars. Small complaints to compliment the large.³³



LOVE AT HOME,
circa 1874



DISTRESS AT SEA,
circa 1873

The cable-laying problems know no end. On September 16, 1874, Werner gives up hope for the time being. The cable cannot be found, even after **eight days of anxious hope and expectation**. It is simply gone. **It is quite a blow for us, financially and morally, but it must be endured!** Poor weather, unexpected large depths, and certain follies in equipping the ship caused our mishap. Now, we must fight back and not lose heart! Everything is being prepared to give it another shot in a few weeks with even better resources at our disposal. I cannot yet say what I can and must personally do

to that end. It is a fact we must accept without losing the courage to keep pressing on!³⁴

His tone toward Antonie is different than in his letters to Mathilde, probably due to the different phases of life in which they were written. With Mathilde, Werner is young and at the beginning of a career with an unforeseeable future. He shares his fears and insecurities, and takes encouragement and strength from her. Later, in his marriage with Antonie, he is considerably older (and much older than her), and a successful businessman who knows a thing or two about making decisions.



THE GIFT OF A BILLY GOAT

How a billy goat from the Caucasus found its way to the Berlin Zoo.

WERNER VON SIEMENS *Russian Oven*

In 1833, Martin Hinrich Lichtenstein, professor of zoology and director of the natural history museum in Berlin, takes an academic trip to London. A visit to the local zoo gives him an idea. Upon his return, he suggests to Peter Joseph Lenné, director-general of the royal Prussian gardens, to create a zoo at the Berlin Tiergarten, a public park under royal authority. An interesting proposal, but there is one problem: King Friedrich Wilhelm III doesn't like it. He would have to cede control of parts of the garden, which he isn't prepared to do.

After Friedrich Wilhelm's death, Lichtenstein makes a fresh attempt in 1840, proposing that the zoo be run by a private company. This persuades the new king, Friedrich Wilhelm IV, and gets the ball rolling on the zoo. A working group led by Lichtenstein and Lenné draws up the plans, and the project begins in 1841. The king gives up 22 hectares of the royal pheasant grounds to the zoo, moves his pheasant house to Potsdam, and gives the new company a loan of 15,000 thaler.

Construction begins in 1842, and the zoo opens on August 1, 1844. The top attraction is the primate house, which several hundred visitors flock to see every day. Soon, a female Asian elephant arrives at the zoo. A carnivore house follows in 1866. And in 1869, Werner gives the zoo a gift.

It is a «souvenir» from a trip to the Caucasus. There, Werner decided to bring a steinbock, also known simply as a wild billy goat, back with him to Germany. It is quite a valuable animal, but what does one do with a billy goat from the Caucasus in Berlin? Initially, it lives in the garden of Siemens' villa in Charlottenburg. Werner's daily walking route from the villa in Charlottenburg to work on Markgrafenstrasse in Berlin takes him past the zoo. [There you have a great deal of shaded promenades nearby](#), he writes Mathilde in 1861 to describe to her the surroundings of the villa. [The zoo isn't far, and 40 coaches pass directly by the front door to Berlin. You have life, shade, solitude and peace, just as you'd want, and I've found a suitable, precisely one-hour walk to Berlin through the Tiergarten, for which I don't need to spend half of the time walking on the stinking, filthy streets.](#)³⁵

It may occur to him on one of these walks: why not give the lonely goat to the new zoo? A formal letter follows:

[To the Directorate of the Zoological Garden personally. I intend to make a gift to the Zoological Garden of a steinbock, around three years old, that I brought back from the Caucasus. In the interest of conserving this rare and costly animal, I attach the condition that he is afforded accommodation in your garden that is fitting to his nature. I look forward to your response, if and how you would be able to meet this condition. The billy goat is in my garden in Charlottenburg, Berliner Str. 36, and can be viewed here at any time.](#)³⁶ The zoo is indeed able to fulfill the conditions, and the billy goat soon has a new home.



DISPATCH CENTER Arnold, Käthe, Wilhelm, Hertha, Werner, Anna, Carl Friedrich, and Antonie, 1875

A GOOD FATHER IS FULL OF SOUND ADVICE



Werner is a family man through and through. He provides his six children with direction and guidance for life.

Like many fathers of his time, Werner is confronted with the conundrum of how to prepare his children for the path of life ahead. What matters, or should matter, for his sons? What about his daughters? What norms should he impart? What conventions must be retained? As the head of a middle-class family, he spends less time at home and more time away working—a characteristic of many fathers of his generation, and in his case, the absences are long and the distances great. That meant the duties of upbringing are often carried out in letters, especially since the children of his first marriage must make do without a mother for a time. But the rules of life are important, and therefore they must to be taught to the children. While his letters show unassailable beliefs and attitudes, his tone always remains moderate and empathetic.

The correspondence isn't always smooth and steady. Arnold, at 13, has become delinquent in his replies, causing his father to once more reach for his pen:

If you don't want to write me, then I'll just have to write to you. You probably want to write something very wise and special and are afraid of falling short. But this is not right. You must write what comes to mind, what you truly think and feel right then. That can't be so difficult? Carefully calculated letters would not please me. If you tell me that you are cheerful and happy, and that from time to time you think of your siblings and father, who all love you so—that would make me happy, and I would ask nothing more from you, as you are now traveling.³⁷

The message Werner hopes to teach his children is that writing is a reflection of a person. From his sons, he expects concrete, vivid reports—**vapid wisecracks** are the stuff of **jesters and other simpletons**, he writes in a letter to Wilhelm, who is 19 at the time. He gives him precise stylistic instructions on what is effective in a letter and what is not. Above all, he tells his son to avoid becoming

a [Berlin socialite](#) or a stogy hack writer, and to not make rambling or contrived jokes that cause only [headaches](#). They don't make a good impression or say much about the writer, either.

ETERNAL TRUTHS OF MANHOOD

In May, 1876, Werner writes his son Wilhelm a letter about two months before his 21st birthday with five guiding principles for life:

1. Pay little attention to what others think of you.
2. Don't speculate, act.
3. In everything that you do: Keep it simple.
4. Be straightforward and natural, especially in speaking.
5. The deeds make the man, not the garlands.

Word for word from his letter: [Regarding the remaining contents of your letter, I recommend not placing too much emphasis on what one says about another. A person's take on the feelings of others is based on his own personal judgement. \[...\] I'd like to give you one more piece of advice, and that is to not to brood too much about yourself and the way of the world. Always put yourself forward as you are, not as you think you should be. The latter cripples performance and vigor.](#)

It is the advice of a man who knows that anything simple and direct is often the most difficult to convey. Once it is achieved, however, the impact is great. [It is very easy and straightforward to write a few lines to relatives and friends if you only write about what is in your head at that moment. It is much harder, however, to write with wit and all the like! The greatest art and depth ultimately comes from simplicity and ease of expression, while anything stilted will miss the mark. Simple and natural in speaking, writing, and in appearance, with «plus être que paraître» — that](#)



WERNER'S SON WILHELM, 1875

Short and sweet: Werner's parental address to Wilhelm

In addition, I would like to ask you to promptly and openly share the important events of your life with me in the future. That I only heard by second and third-hand accounts of the arson you endured was a bit irksome. Grant me through your letters real insight into your material and mental state in plain and simple terms. Writing this way is a grand and useful art that one must

embrace early on. Witty remarks are quite nice when they appear unnoticed, but quite trite when they are forced. Then they simply form the vapid wisecracks of the much-lauded Berlin socialites, which are only good for headaches! I prefer to leave this to the court jesters and other simpletons who have nothing more sensible in their empty heads than bad jokes.³⁸



is the recipe to gaining long-lasting recognition and esteem. The master emerges when he enters the practice of life just as nature has created him. Ultimately, the deeds make the man. Take serious preparation for strenuous days so that you may seize an opportunity when it comes. The form this takes will take care of itself!³⁹

AN ARTIST? I DON'T LIKE IT ONE BIT

Like their father, the children travel a lot as well. Their frequent trips can be partially attributed to their education, but there are also trips related to medical treatment, as is the case with Arnold and his heart condition. To ensure they still receive «input» from their father, Werner Siemens intensifies their long-distance upbringing, especially when he becomes more involved in raising them after the death of his first wife, Mathilde. At the very least, this means preparing his sons to take over the company — and to steer them away from possible diversions. In response to comments from an art teacher about Arnold's talent for drawing, Werner only seems to have a smug comment in a letter to his brother William on April 8, 1868. *Arnold has already been in Bossey and proceeded to Vevey. To hear his teacher Nothnagel tell it, the boy is going to be the next Raphael! I don't like it one bit.*⁴⁰ A few weeks later, he poses a question to his brother Carl: *Good news from Arnold, but still not all is well. His art teacher says he has the potential to be a great artist! It would be quite odd if our successors would become artists. Where did this come from?*⁴¹ Where indeed? To the rationally-inclined mind of an engineer, having a son as an artist is an idea as unimaginable as it is undesirable.

YOU ARE NO LONGER A CHILD

Another trip causes Werner to miss the confirmation of his daughter Anna in 1874, and therefore the quintessential things a father might say to his daughter on that occasion come in the form of a letter. *These lines will probably reach you just in time for your confirmation, and I am extremely sorry I cannot be standing at your side!* he writes from London. *This is a very important day for you, and you should let it sink in so it stays with you your whole life. This day means you are no longer a child and are henceforth responsible for your own actions. It means you have been adequately instructed and mentally prepared to take over and carry out this responsibility on your own.*

The fact that obligation and responsibility are mentioned first and foremost, and that even love seems to be an afterthought, is typical of the time period and their social standing. *You should understand the religious and moral truths you have been taught and have made your own, so that you can base your actions on them in the future. Every mistake you make from now on is your own fault, which you will atone for sooner or later. Starting now, you should consider yourself a free, self-determining member of society, and should recognize that love is the bond that makes life on earth either heaven or hell — depending on whether the bond is strong and reciprocated, or rotten and attached to unworthy objects!*

FATHER'S BLESSING KISS

Werner is aware of the responsibility he carries toward a child that lost her mother at an early age, and despite all seriousness in life, wants to feel emotions. *You are in a regrettable position, my poor child — you lost your mother too early to properly prepare*

your heart! If she were alive and you were still attached to her, her noble spirit and the devoted and unselfish love that consumed her would have softened the natural state of your soul and ignited love! Your good sense and good judgment must now make up for what was lost in earlier years.

Comfort, to everyone's «luck,» comes from another. You can consider yourself lucky to have found a second mother who is trying faithfully and lovingly to replace what you lost and cast my approaching age in a positive light. Approach her with all your heart! It will prove to be invaluable support for your future life [...]. And I hope, dear Anna, that you appreciate your confirmation day in its importance and that it leaves behind a lasting and beneficial impression and success on you! May your father's blessing kiss, which your second mother will place upon your forehead in my stead, accompany you on a long, happy life that is blessed with love!⁴²

THREE IMAGES OF ANNA

circa 1864, 1873, and 1939



WHAT MAKES A WOMAN?



The rules of middle class morals were spelled out very precisely in the 19th century. For women, taking part in intellectual or political life was taboo.

The image of a woman that Werner presents as the natural ideal completely embodies the spirit of those times. What a woman is, and more importantly, what she isn't, is explicitly defined in the bourgeois canon of values. There was little leeway; transgressions were all but inevitable. Whether serious or harmless, the rules of society had retribution prepared for every degree of deviancy, which was to be avoided at all costs.

A woman's place was to stay out of the public eye and to establish a home and family life in what was seen as her inherent domain. Participating in intellectual, let alone political life, was not an option. On the contrary: a woman's nature, according to the science of the time, was diametrically against it.

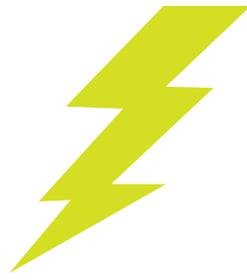
From today's perspective, Werner's advice seems amusing, if not absurd, but it can be assumed for him that this was a part of his paternal duty and responsibility. In the end, he only thought of what was best for his daughter, by opposing [...] [young girls appearing at public festivities before they are fully developed and grown](#). You, as you know, must be very careful not to interfere

with the healthy development of your lungs. [...] I expect you to take reasonable consideration for your health, and never dance to overheating or exhaustion, never drink cold drinks, and anxiously protect yourself from every chill. [...]

As I have heard from many sources, you enjoy making a show of religious freethinking by parading misunderstood theories of Darwin and drawing even worse conclusions [...].⁴³

What follows in his letter to Anna three days later is a glimpse into the way men viewed a «woman's nature» at that time.

It is not the mind or acquired knowledge, but the character and characteristics of the heart that form a person's value to fellow human beings. This is true for a woman much more than it is for a man. [...] It is only in rare cases for a woman's own achievements to give her merit to mankind. It is in her nature to rely on the power of her personality and its influence on others. Like a fragrant flower, a woman must create a feeling of comfort in everyone she encounters. Not with coquettishness or deliberate endeavors, but with her innermost essence, which is always on display thanks to her spirit of ideals, good, and beauty, through her sympathy for the pain and the joy of others, through mild and tolerant judgment, through a thankful and loving disposition. Such a woman is in truth the crown of creation, and reigns through the respectful affection that guides her everywhere she goes. I would like to see you strive for such an ideal, my dear little daughter.⁴⁴



THE GODLESS EXPERIMENT

At the pyramids of Egypt, Werner upsets the locals with an electrically-charged bottle — but like many of his contemporaries, is fascinated by the treasures of the country.

Today, we would probably say, «typical nerd» — someone who becomes completely absorbed by whatever he does, without really registering how others might think and feel. The occasion is a trip to the pyramids. Werner writes Mathilde how he climbs the pyramids and is caught in a sandstorm. The peculiar hissing sound, which forms on every fingertip, reminds him vividly of discharging electricity. That is all it takes to awaken his experimental spirit and to start the godless experiments. He feels compelled to show his Arab tour guides the electricity latent in the air. Who would have thought that this might frighten the sons of the desert, as he calls them?

The storm gives Werner the idea to demonstrate how a Leiden jar works. The oldest form of a capacitor consists of an open-topped cylindrical insulator — usually a glass vessel — that has its inner and outer surfaces covered with two insulated, conductive layers — made of tin or aluminum foil — up to two-thirds up the sides. A metal rod juts from the opening of the jar and connects it to the inner layer. This is how the charge is generated. If the rod provides the jar with a negative charge, a positive layer forms on

the outer layer. Anyone who touches it receives an electric shock—which seems to greatly disturb the clueless Egyptian guides. But for Werner and his companions, it is great fun!

Yesterday we visited the pyramids of Giza, he writes his wife Mathilde in April, 1859. He climbs the pyramids with the help of lightly-clad sons of the desert and looks across the Nile Valley, likely in poor visibility because of the storm: The 20 to 30 Arabs, who were perched above us in picturesque groups [...] suddenly sprang up and pointed the forefinger of the right hand to the winds. A peculiar hissing sound formed on each fingertip, which vividly reminded me of discharging electricity. When I raised a half-empty wine bottle, I heard the same sound and clearly felt small sparks from the label of the bottle jump to my hand. Using a full bottle, which was wrapped in tinfoil, I was able to create a strongly-charged Leiden jar, which created such a shock upon contact that the Arabs fled the top of the pyramid aghast and protested against our godless experiments. It was endless fun and let us soon forget the bad view.⁴⁵ This is not one of the typical pleasure or academic trips to Egypt popular among well-to-do Europeans at the time. As usual, Werner's travel—this time with William Meyer— involves work, which is related to laying the

EGYPTO- MANIA

The dawn of the 19th century: On the trail of Ancient Egypt.

When Werner regrets not being a scholar of antiquity, this is certainly a reflection of the great interest in Egypt during this time. It was fashionable for affluent Europeans to finance an archaeological dig and participate in it themselves, or at least to undertake a trip to Egypt and bring home objets d'art. It was the German researcher Karl Richard Lepsius who furthered the archaeological exploration of Egypt. Between 1842



Red Sea cable. Werner uses any downtime for excursions to the impressive attractions in the region. To really appreciate their meaning, however, he thinks he would need the trained eye of an archaeologist. Instead, with regards to the buildings and artifacts—evidence of an advanced civilization now lost—he is left only with [astonishment](#).

I found the newly-discovered tomb of Apis particularly interesting—huge, underground passages in which about a dozen monstrous coffins of polished granite were laid. Every coffin could have held at least a half a dozen oxen. At first we wanted to spend the night in one of the coffins, as some of them were open, but the camp was too harsh. We could lay quite comfortably in the vaults on the sand. In the morning I saw a hyena, which quickly scurried away as soon as it saw us. [...] This colossal necropolis is really very interesting. It is too bad I am not a classical scholar able to envision the customs and habits of the people buried here from the countless remains and inscriptions. With our ignorant eyes, the best we can do is stare in [astonishment!](#)⁴⁶

and 1845, the Prussian scholar was sent on a grand expedition to Egypt by the Prussian King Friedrich Wilhelm IV. What he brought back with him were innumerable transcripts of hieroglyphics, architectural pictures of historical structures, and topographical maps. Lepsius was the very first to initiate excavations in Egypt. In the second half of the 19th century, the exploration of Ancient Egypt proceeded apace as more and more

scholars were drawn to the Nile. The presentation of a mummy was a major social event for anyone who had discovered one. During this period, the Berlin Academy also compiled a comprehensive Ancient Egyptian dictionary. The biggest excavations began under Ludwig Borchardt, who uncovered whole structures and complexes for the first time.

ROYAL BLUNDER

Otto von Bismarck
with his wife
Johanna



DINING WITH THE MIGHTY

Werner is in demand. Even Reich Chancellor von Bismarck values him as a collocutor. But Johanna von Bismarck almost slips up.

June 21, 1880: There are cigars. The dog lays his muzzle on the table. During dinner, the Duke grumbles about the nobility and politics, while the Duchess tells of her attempt to buy a «Siemens Electrotherapist» at Werner's factory. Reich Chancellor Otto von Bismarck had invited Werner as a guest, but his wife unwittingly broaches an uncomfortable — if not infuriating — topic for Werner: the «Siemens Electrotherapist» is not a device made by his company. The questionable product is much more an example of how the good name of Siemens is being abused at the

time, and even Johanna von Bismarck is about to be hoodwinked by this scam...

A MISERABLE EFFORT WITHOUT RHYME OR REASON

On April 27, 1880, Werner writes to his brother: *Since my return, the bogus company Siemens & Co. has occupied me greatly. Everyone believes that myself or the company are the creators of this device [...]. The apparatus is a simply miserable effort calculated on deception without rhyme or reason, worth at most a few pennies. I have now discovered that the Siemens listed in the address book as a typesetter is a born Berliner and son of Siemens the sacristan [...]. The second associate is a small locksmith. The actual creator and likely the coconspirator is the corrupt contractor of Carl's carved furniture, Löwenthal! I'm going to report the company to the public prosecutor for treacherous fraud as soon as I've conclusively gotten to the bottom of the issue of the name.*⁴⁷

In the meantime, as Werner sits at the Bismarck's table dining with the mighty, Johanna von Bismarck brings up the «Electrotherapist» of all things, a scam by a couple of Berlin counterfeiterers. Looking back, he describes the scene as *hilarious*.

THE REICH DOG WAS THERE TOO

On June 21, 1880, Werner informs his brother Carl: *I've just received [...] an invite from Bismarck to go to dinner tonight at 6 p.m. — in a tailcoat, no less! I'm curious to see the lion in his lair!*⁴⁸ A few days later, William is in touch to find out more about the evening. «I'm curious to know how your dinner with Bismarck went.»⁴⁹ Werner replies on June 28, 1880: *My dinner at the lion's den was quite interesting. Only the closest family and his two «hands,» Benker and Tiedemann, were there. I sat between*

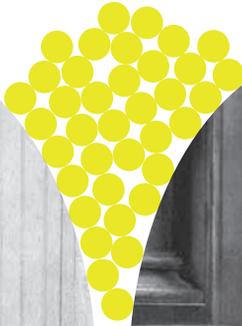
Bismarck and the Duchess, whom I led to the table. Of course, the Reich dog was there, too — putting his nose on the table quite normally. He behaved himself rather well, even when the daughter offered him a sausage!

Two years prior, badly-behaved canines almost resulted in a diplomatic spat. Bismarck was a well-known dog-lover and had set his heart on Great Danes, some of which accompanied him at the 1878 Berlin Congress. The scene was not only strange for all the state guests, but also consequential for one of those attending: a sudden dog attack resulted in tattered trousers and a terrible fright. In German, «Reichshund» (Reich dog) became a word often used to refer to a Great Dane. The ridicule from the public came free of charge, and therefore Werner's mildly mocking tone regarding the authority figures is not a mere coincidence. The evening with Bismarck continues:

Bismarck grumbled in his usual manner about everything he didn't like: court, parliamentary parties, etc. He was quite leisurely after dinner, smoking his pipe on the big balcony as we smoked cigars! [...] We spoke about all sorts of things, as I was the only guest and I didn't mince my words, which he seemed to be fine with. A particular reason for his invite wasn't discernable [...]. But it's good to have become acquainted with him personally. Hilariously, the Duchess told me that she had recently visited our factory in secret to buy herself a Siemens Electrotherapist on the recommendation of her doctor. She was not given a pleasant reception by the staff, and was glad she was able to leave without being recognized!⁵⁰



WERNER,
circa 1865/1870



EMPRESS ELISABETH,
circa 1874

THE LOVELY EMPRESS

Interacting with the ruling houses is important, even if it means courtly gestures from Empress Elisabeth herself keep Werner waiting for hours in a tailcoat and tie.

Werner is in demand. He had opened the door on a new era, which rouses a lot of interest. Throughout his life, Werner talks about what is possible and feasible with the new technology, and how electricity will change the world. The aristocracy are among those who listen. [I recently had to give a lecture to the Imperial family about electricity and its use in life](#), he writes to his brother William. [The nobility took great interest in the subject](#),

particularly the Empress and the Crown Prince. Kaiser Wilhelm I, on the other hand, seemed to be somewhat tired of the new technology. According to Werner, the Kaiser complained: **one doesn't understand.**⁵¹

Contact to the ruling houses was important for business. In early summer of 1883, Werner writes to his wife Antonie that he is reluctant to go to the Crown Prince in Potsdam, but does not want to alienate himself by failing to attend. **If I don't go to Potsdam, then the marked estrangement which the future rulers have shown to me in recent years will continue – and that wouldn't be good. Besides that, I need the Crown Prince to bring Minister Meybach in line, as he does not want to free up Schwieger for two years to work on the Vienna railway. Influential figures from Vienna are also on the jury, who I need to win over for Vienna's electric railway. In short, I must go to Potsdam. Business before pleasure – says the engineer to his bride.**⁵²

Werner seems to develop his ironically distant relationship with the aristocracy and ruling houses early on. In a letter

TECHNOLOGY AND RATURE

The technical achievements of the 19th century were reflected in the literature of the time: the work of Theodor Fontane is one example.

In Fontane's late work »The Stechlin«, he writes: «The devil is not as black as he is painted, and nor is telegraphy, and nor are we. Ultimately, it is a marvelous thing: these natural sciences, this electric current, tap, tap, tap, and if we wanted to [...] we could let the Emperor of China know that we are gathered here and were thinking of him.»

Theodor Fontane, born three years after Werner von Siemens, is considered the outstanding exponent of bourgeois realism. He held up a mirror to the world of 19th century



dated February 25, 1855, he writes from Vienna to his wife Mathilde: Besides the business visits, I was at the Burgtheater on the first evening, where the company and especially the immediate proximity of the imperial court were of interest to me. The Kaiser looked like a young madcap, laughing heartily and without embarrassment at every bad joke, and, despite the proximity of five paces, gave me the honor of persistently lingering a few times. The naïve little Empress looks lovely, almost childish, and reminds me of a little of Ms. Du Bois.⁵³ The woman he refers to is the wife of a good friend Emil Du Bois-Reymond, a companion from his time with the Physical Society. Within Werner's quiet mockery, it is also possible to see the self-awareness of the then still-aspiring entrepreneur who knows where he stands and what he represents. Almost 20 years later, in June 1873, he recalls to his second wife, Antonie, the reception of the lovely little Empress Elizabeth, who is known as Sisi: The Empress will be the end of me. It is quite boring to be kept waiting for hours in tailcoats and a white tie, even if she is courting Hofmann and me.⁵⁴

Prussia, and part of this rapidly changing world was the technological developments of his time. Be it electricity, steamship travel or the aforementioned telegraph, technical achievements are mentioned repeatedly and self-evidently in his novels and travelogues. They contribute to the challenges that confront his characters, in terms of their thinking, their judgment and their actions. However, his novels are centered not on the repercussions of scientific and technological advances but on the accompanying social and cultural

upheavals that disturb his characters' psyches and understanding of the world. It stands to reason that he would, on occasion, have based these characters on contemporary personalities, such as the inventor Werner von Siemens. Christian Thomas, in his book «Theodor Fontane – Autonomie und Telegraphie in den Gesellschaftsromanen» («Theodor Fontane – Autonomy and Telegraphy in the Social Novel»), explores the clear parallels between Robert von Gordon, an engineer in the novel «Cecile», and the real Werner von Siemens.

GREETINGS FROM YOUR WICKED, EGOISTICAL, DECREPIT OLD BROTHER

Everything for the family: Werner isn't just leading a company. He directs a family as well, and all that goes along with it. Disputes between the brothers are practically inevitable.

WERNER VON SIEMENS Russian Oven

For Werner, companionship means friends, research or science colleagues, or other entrepreneurs, but above all it means family. Innovations are often developed together with his brothers, and important jobs for the company — particularly jobs abroad — are assigned to family members. Werner is a family man through and through, and he builds his staffing strategy on loyalty.

His family drives him, and his concern for them is an integral part of his company. His standing as a much-respected creator seems much less important to him than being able to feed the family based on the success his status creates. Werner's leitmotif is his family. Nevertheless, conflict isn't always kept at bay, with Werner and his brother William sometimes at odds with each other. Correspondence with Werner's much younger brother, Carl, is mostly cordial. But after William's death, Carl begins to disagree with Werner more frequently and vehemently in his letters.

HIS BROTHER, CARL, IS DEEPLY WOUNDED WHEN WERNER ACCUSES HIM OF WORKING SIMPLY TO MAKE MONEY, WHEREAS WERNER HIMSELF PURSUES HIGHER OBJECTIVES.

You really wanted to find fault with me, and so it was my poor character that had to pay. But what would a stranger say, were he to read your letter? He would have to say: This Carl fellow is an indolent, hedonistic, money-grubbing lumberjack, who would never be capable of sacrificing a penny for any idea, whereas you in Berlin are the disinterested, idealistic, intellectual workers. [...] I have only ever regarded money as a means to an end; however, on the other hand, I have always been of the opinion that a successful business must ultimately be expressible in figures. No one has ever made a name for himself with financially unsuccessful businesses. [...] Farewell, dear Werner. With warmest regards from your loyal, hedonistic, indolent and money-obsessed lumberjack and brother Carl.⁵⁵



WERNER TAKES UP THE BALL AND PLAYS IT BACK, IN A TONE OF GENTLE IRONY.

At any rate, you are very much mistaken if you believe I wanted to find fault with you and to belittle your character! What a funny idea! To me, you and Fritz have always been the prototypes of a thoroughly estimable character. So there is no need for you to be perfect! [...] Warmest regards from your wicked, egotistical, decrepit old brother Werner.⁵⁶



CARL, circa 1888



WERNER, circa 1888



THE SIEMENS BROTHERS Friedrich, Werner, Ferdinand and Carl, circa 1888

And when the brothers quarrel, it isn't just about the business. Their different personalities mean different views on all manner of things, including how to live and how to work.

THE EMPIRE I CREATED

It cannot be said that Carl or any other brother is less concerned about the family than Werner. After all, Carl, who had been in Russia for quite some time, moves to England following the death of his wife Marie—in the interests of the business, but also as a gesture to Werner—to support William with business in London,

and doesn't return to Russia until the 1880s. Despite this, Werner writes to Carl in 1887: *Fact is you've always placed a greater emphasis on material goods while I've been chasing too many fantasies and ideas. [...] The business as a monetary object comes second to me. For me it is much more like an empire that I created and want to leave intact to my children so they can continue to invent.*⁵⁷

Werner's top guiding principle is to always have the best interests of the family and the company's existence at heart — a position he also expects from his brothers. A letter to Carl from September, 1855, leaves absolutely no room for doubt in this regard. For Werner, even a honeymoon is shaped by utility and reason. Enjoyment and pleasures are one thing, constant *cold-calculation* in business is another. Seniority and responsibility dictate that *in regard to this, dear Carl, on the trip you'll have to keep what's practical and useful in mind. I wish you both from the bottom of my heart a pleasant, worry-free and enjoyable trip around half or all the whole world! But cold-calculation will provide a contrasting view. You, as the youngest, most recent member of our company must now excel in strenuous, useful tasks in the interest of the business.*⁵⁸

Poor Carl? Hardly — he would have expected nothing less from his brother. Nor would his newly-wedded wife, Marie. Duty, discipline, responsibility and care create the long-lasting melody of the Siemens family, a reflection of the time and their social standing. The strict divide between work and pleasure in this family failed in any case to be upheld — if it had ever been something worth striving for anyway. Werner took on the paternal role in every sense. Reminding the family of their duties and responsibilities, criticizing them, recognizing their achievements — it is all part of his position as head of both the family and the company. The game has begun, and so it will be played.

THE LETTERS STOP COMING

Werner von Siemens dies on December 6, 1892.

In 1890, at the age of 73, Werner steps down as chief of his company and hands the business over to his brother Carl and his sons Arnold and Wilhelm — true to his endeavor from the very start of giving his empire to his descendants as [intact](#) as possible. Unsurprisingly, he continues to have a decisive influence until his death. After stepping down, he has the opportunity to continue working on his memoirs, to go over everything again: his childhood, his days in the military, research, exchanges with the great minds of his time, inventions, the rise of the company, fame, influence — and the revolutionary developments of his time, many of which bore his handiwork.

One of his last letters contains once again everything that had occupied and accompanied him all his life: invention, vision, bureaucratic hurdles, and solutions. The letter is dated August 4, 1892 and addressed to his brother Carl: [They want to prevent Germany from participating in telegraphic world communication. But I've thought of some older ideas which could at least double the speed of speech on undersea cables. This would make an Emden-New York cable possible and profitable. However, patents in England and America must first be negotiated, and there's still much experimenting to do. That will be a splendid matter indeed for the underground lines as well. The good news has properly refreshed me! I'm not dead just yet.](#)⁵⁹

After his burial, which is attended by countless guests from aristocracy, politics, business, and society, the loss to the family becomes quite clear during those sad days of the winter of 1892/1893: His words are missing, his letters are missing, he is missing. Carl writes to his nephew Wilhelm: «I cannot describe to you how much I miss him right now and will continue to miss him for a long, long time to come. Remember that for more than 40 years, we have regularly shared everything that has moved our hearts. I rarely received less than a letter a week from him, and he from me. So, actually, we have always lived together, though we were physically separated from each other. Now that has suddenly ended and I feel, of course, very lonely. We accustom ourselves to everything and so I will get used to it, but for the time being, it's quite hard.» Carl, who is to continue the company in the spirit of his brother Werner, together with Werner's sons Arnold and Wilhelm, once again shows his unconditional loyalty to the family and the company. «Perhaps it's not known to you that your good father told me every time I went to Berlin, that I should move there if he was to die first. [...] I never promised him that I would fulfill his wish, but always emphasized that I didn't want to get in the way of his sons. I will always adhere to this, but if it's a question of your well-being or the business, then you will always find me.»⁶⁰





APPENDIX

FOOTNOTES

BRIMMING SPIRIT

- 1 Werner Siemens to his brother William. Berlin, December 14, 1846
- 2 Werner Siemens to his brother William. Berlin, January 3, 1847
- 3 Werner Siemens, *Recollections*. p. 63
- 4 Werner Siemens to his brother Carl. Berlin, May 22, 1857
- 5 Werner Siemens, *Recollections*. p. 65
- 6 Werner Siemens, *Recollections*. p. 81-82
- 7 Werner Siemens to his brother Carl. Berlin, January 23, 1883
- 8 Werner Siemens, *Recollections*. p. 45
- 9 Werner Siemens, *Recollections*. p. 48
- 10 Werner Siemens, *Recollections*. p. 383
- 11 Werner Siemens, *Recollections*. p. 53
- 12 Werner Siemens, *Recollections*. p. 53
- 13 Werner Siemens, *Recollections*. p. 53
- 14 Werner Siemens, *Recollections*. p. 65-66
- 15 Werner Siemens, *Recollections*. p. 52-32
- 16 Werner Siemens to his brother William. Berlin, June 15, 1874
- 17 Werner Siemens to his brother William. Berlin, December 4, 1866
- 18 Werner Siemens to his brother Carl. Berlin, March 4, 1867
- 19 Werner Siemens, January 27, 1880, Speech to the Berlin Electrical Engineers Association
- 20 Werner Siemens to his brother Carl. Berlin, June 12, 1879
- 21 Werner Siemens to his brother William. Berlin, May 23, 1881
- 22 Quoted from Artur Fürst: *Werner von Siemens. Der Begründer der modernen Elektrotechnik*. Berlin 2016, p. 99
- 23 Werner Siemens, January 27, 1880, Speech to the Berlin Electrical Engineers Association
- 24 Werner Siemens, January 27, 1880, Speech to the Berlin Electrical Engineers Association
- 25 Werner Siemens to his brother Carl. Berlin, February 21, 1880
- 26 Werner Siemens to his brother William. Berlin, May 12, 1880
- 27 Werner Siemens, *Recollections*. p. 79
- 28 Werner Siemens to his brother William. Berlin, July 15, 1846
- 29 Werner Siemens to his brother William. Postmarked on August 25, 1847
- 30 Werner Siemens to his brother Carl. Berlin, September 7, 1875
- 31 Werner Siemens to Wilhelm Drumann. August 1848
- 32 Werner Siemens, *Recollections*. p. 124
- 33 Werner and Wilhelm Siemens, Telegram exchange. Berlin/London, July 2, 1874
- 34 Werner Siemens to his wife Mathilde. Near Korfu, March 30, 1859
- 35 Werner Siemens to his employee Carl Haase. Ballinskelligs Bay, September 9, 1874
- 36 Werner Siemens to his brother Carl. Berlin, November 6, 1877
- 37 Werner Siemens to his Excellency Lüders. Berlin, November 15, 1877
- 38 Werner Siemens to his brother William. Charlottenburg, November 19, 1877
- 39 Werner Siemens to his brother Carl. Berlin, November 29, 1877
- 40 Werner Siemens to his brother William. Gießen, January 22, 1849
- 41 Werner Siemens to his brother Carl. Berlin, December 7, 1877
- 42 Werner Siemens to his brother William. Berlin, June 4, 1874

- 43 Werner Siemens to Dr. Rosenthal. Berlin, September 17, 1884
- 44 Werner Siemens to Dr. Rosenthal. Berlin, September 17, 1884
- 45 Werner Siemens to Minister von Goßler. Berlin, January 12, 1884
- 46 Werner Siemens to his nephew Alexander Siemens. Berlin, March 12, 1886
- 47 Werner von Siemens to his sister Sophie Crome. Berlin, May 11, 1888

GLOBAL AMBITION

- 1 Werner Siemens to his wife Mathilde. St. Petersburg, March 20, 1854
- 2 Werner Siemens to Dr. Rosenthal. Charlottenburg, April 15, 1886
- 3 Werner Siemens, *Recollections*. p. 130
- 4 Werner Siemens to his brother William. Berlin, January 4, 1847
- 5 Werner Siemens to his brother Carl. Berlin, January 27, 1865
- 6 Werner Siemens to his brother William. Berlin, November 11, 1867
- 7 Werner Siemens to his brother William. Berlin, September 15, 1847
- 8 Werner Siemens to his brother Carl. Charlottenburg, December 25, 1887
- 9 Ewald Blocher: *Johann Georg Halske. Lebenswege*, Vol. 1. Munich 2014, p. 9
- 10 Werner Siemens to Wilhelm Drumann. Berlin, January 12, 1847
- 11 Werner Siemens to Wilhelm Drumann. Berlin, January 25, 1847
- 12 Werner Siemens to his brother William. Berlin, January 25, 1847
- 13 Werner Siemens to his brother William. Postmarked on August 25, 1847
- 14 Werner Siemens to his brother William. Berlin, November 29, 1847
- 15 Werner Siemens to his brother William. Berlin, December 14, 1846
- 16 William Siemens to his brother Werner. Manchester, December 22, 1846
- 17 Werner Siemens to his brother William. Berlin, April 28, 1863
- 18 Werner Siemens, *Recollections*. p. 161
- 19 Werner Siemens to his brother Carl. Berlin, July 1853
- 20 Werner Siemens, *Recollections*. p. 179-180
- 21 Martin Lutz: *Carl von Siemens. Lebenswege*, Vol. 2. Munich 2014, p. 15
- 22 Werner Siemens to his brother William. Berlin, December 5, 1854
- 23 Werner Siemens to his brother William. Charlottenburg, August 30, 1863
- 24 Werner Siemens to his wife Mathilde. Paris, February 1864
- 25 Mathilde Siemens to her husband Werner. Berlin, February 15, 1864
- 26 Werner Siemens to his wife Mathilde. Cagliari, September 1, 1857
- 27 Werner Siemens to his father-in-law Wilhelm Drumann. Kreuznach, September 16, 1857
- 28 Werner Siemens to his brother Carl. Berlin, April 12, 1870
- 29 Werner Siemens to his brother Carl. Berlin, January 24, 1867
- 30 Werner Siemens to his brother Carl. Paris, September 29, 1881
- 31 Werner Siemens to his brother William. Berlin, December 4, 1866
- 32 Werner Siemens to his brother Carl. Berlin, February 6, 1882
- 33 Werner Siemens to his brother Friedrich. Berlin, November 30, 1881
- 34 Werner Siemens to his brother Carl. Charlottenburg, December 11, 1881
- 35 Werner Siemens to his brother Carl. Berlin, July 5, 1879
- 36 Werner Siemens to postmaster general Heinrich von Stephan. Berlin, February 5, 1879
Quoted from William Chatterton Coupland (translation): *Recollections*. p. 390-391
- 37 Werner Siemens to his wife Mathilde. St. Petersburg, May 6, 1855
- 38 Werner Siemens to his brother William. Berlin, November 5, 1867

- 39 Werner Siemens to his brother Carl. Berlin, May 26, 1865
- 40 Werner Siemens to his brother Carl. Charlottenburg, December 25, 1887
- 41 Werner Siemens to Eduard Rau. Berlin, January 18, 1876
- 42 Werner Siemens to his brother Carl. Berlin, April 11, 1866
- 43 Werner Siemens to his brother Carl. Berlin, June 16, 1868
- 44 Werner Siemens to his brother William. Charlottenburg, April 10, 1882
- 45 Werner Siemens to his brother Carl. Ragaz, July 17/18, 1868
- 46 Werner Siemens to his brother Carl. Berlin, December 21, 1857
- 47 Werner Siemens to Georg Bolton. Berlin, September 10, 1877
- 48 Werner Siemens to his brother William. Berlin, January 19, 1858
- 49 Werner Siemens to his wife Mathilde. Paris, September 2, 1858
- 50 Werner Siemens to his wife Mathilde. Paris, September 5, 1858
- 51 Werner von Siemens to his sons. Tbilisi, November 3, 1890
- 52 Werner Siemens to his brother William. Berlin, July 12, 1867
- 53 Werner von Siemens to his brother Carl. Charlottenburg, December 16, 1888
- 54 Werner Siemens to his brother Carl. Charlottenburg, December 25, 1884

RUSSIAN OVEN

- 1 Werner Siemens to his fiancée Mathilde Drumann. Riga, January 20, 1852
- 2 Werner Siemens to his fiancée Mathilde Drumann. St. Petersburg, February 4, 1852
- 3 Werner Siemens to his fiancée Mathilde Drumann. Riga, January 22, 1852
- 4 Mathilde Drumann to her fiance Werner Siemens. Königsberg, early February, 1852
- 5 Werner Siemens to his fiancée Mathilde Drumann. St. Petersburg, March 13, 1852
- 6 Mathilde Drumann to her fiance Werner Siemens. Königsberg, February 25, 1852
- 7 Werner Siemens to his fiancée Mathilde Drumann. Berlin, August 4, 1852
- 8 Mathilde Drumann to her fiance Werner Siemens. Königsberg, August 11, 1852
- 9 Werner Siemens to his fiancée Mathilde Drumann. Riga, January 20, 1852
- 10 Werner Siemens to his brother William. St. Petersburg, April 1, 1852
- 11 Werner Siemens to his fiancée Mathilde Drumann. Berlin, June 28, 1852
- 12 Mathilde Drumann to her fiance Werner Siemens. Königsberg, July 4, 1852
- 13 Mathilde Drumann to her fiance Werner Siemens. Königsberg, July 26, 1852
- 14 Mathilde Drumann to her fiance Werner Siemens. Königsberg, August 11, 1852
- 15 Werner Siemens to his wife Mathilde. St. Petersburg, July 31, 1855
- 16 Werner Siemens to his brother Carl. Paris, February 10, 1864
- 17 Werner Siemens to his fiancée Mathilde Drumann. St. Petersburg, March 23, 1852
- 18 Werner Siemens to his wife Mathilde. Kissingen, July 28, 1864
- 19 Werner Siemens to his brother Carl. Berlin, April 28, 1865
- 20 Werner Siemens to his brother William. Charlottenburg, July 3, 1865
- 21 Werner Siemens to Anna Kossobutzki. Berlin, July 14, 1865
- 22 Werner Siemens to his brother William. Berlin, April 28, 1866
- 23 Werner Siemens to his brother William. Berlin, December 4, 1866
- 24 Werner Siemens to his brother Carl. Berlin, August 4, 1868
- 25 Werner Siemens to his brother Carl. Berlin, February 1, 1870
- 26 Werner Siemens to his brother Carl. Berlin, January 7, 1868
- 27 Werner von Siemens to his brother Carl. Harzburg, September 13, 1892
- 28 Werner Siemens to Marie Siemens, née. von Sperl. Berlin, May 23, 1869

- 29 Werner Siemens to his brother William. Berlin, August 11, 1866
- 30 Werner Siemens to his fiancée Antonie Siemens. Berlin, May 31, 1869
- 31 Werner Siemens to his fiancée Antonie Siemens. Berlin, June 5, 1869
- 32 Werner Siemens to his brother William. Berlin, September 7, 1872
- 33 Werner Siemens to his wife Antonie. Ballinskelligs Bay, September 4, 1874
- 34 Werner Siemens to his wife Antonie. Ballinskelligs Bay, September 16, 1874
- 35 Werner Siemens to his wife Mathilde. Berlin, July 15, 1861
- 36 Werner Siemens to the Zoological Garden. Berlin, July 9, 1869
- 37 Werner Siemens to his son Arnold. Berlin, August 2, 1867
- 38 Werner Siemens to his son Wilhelm. Berlin, December 23, 1872
- 39 Werner Siemens to his son Wilhelm. Berlin, May 26, 1876
- 40 Werner Siemens to his brother William. Berlin, April 8, 1868
- 41 Werner Siemens to his brother Carl. Berlin, May 5, 1868
- 42 Werner Siemens to his daughter Anna. London, September 29, 1874
- 43 Werner Siemens to his daughter Anna. Berlin, February 10, 1875
- 44 Werner Siemens to his daughter Anna. Berlin, February 13, 1875
- 45 Werner Siemens to his wife Mathilde. Cairo, April 15, 1859
- 46 Werner Siemens to his wife Mathilde. Near Suez, April 26, 1859
- 47 Werner Siemens to his brothers Carl and Wilhelm. Berlin, April 27, 1880
- 48 Werner Siemens to his brother Carl. Berlin, June 21, 1880
- 49 William Siemens to his brother Werner. Westminster, June 26, 1880
- 50 Werner Siemens to his brother William. Berlin, June 28, 1880
- 51 Werner Siemens to his brother William. Berlin, February 19, 1883
- 52 Werner Siemens to his wife Antonie. Charlottenburg, June 1, 1883
- 53 Werner Siemens to his wife Mathilde. Vienna, February 25, 1855
- 54 Werner Siemens to his wife Antonie. Vienna, June 1873
- 55 Carl Siemens to his brother Werner. St. Petersburg, January 11, 1888
- 56 Werner Siemens to his brother Carl. Charlottenburg, January 15, 1888
- 57 Werner Siemens to his brother Carl. Charlottenburg, December 25, 1887
- 58 Werner Siemens to his brother Carl. Berlin, September 30, 1855
- 59 Werner von Siemens to his brother Carl. Berlin, August 4, 1892
- 60 Carl Siemens to his nephew Wilhelm Siemens. St. Petersburg, December 21, 1892

LITERATURE

- Klaus Beyer (editor): *Kommunikation im Kaiserreich. Der Generalpostmeister Heinrich von Stephan*. Heidelberg 1997
- Ewald Blocher: *Johann Georg Halske. Lebenswege*, Vol. 1. Published by Siemens Historical Institute. Munich 2014
- Mihaly Csikszentmihalyi: *Kreativität. Wie Sie das Unmögliche schaffen und Ihre Grenzen überwinden*. Stuttgart 2007
- Dark Horse Innovation: *Thank God it's Monday! Design Thinking—Wie wir die Arbeitswelt revolutionieren*. Düsseldorf 2014
- Bodo von Dewitz: *Werner von Siemens. Sein Leben, sein Werk und seine Familie. Das Lebenswerk in Bildern. His life, work and family. His life's work in pictures*. Published by Ludwig Scheidegger for Werner Siemens-Foundation. Schwerin 2016
- Richard Ehrenberg: *Die Unternehmungen der Brüder Siemens bis zum Jahre 1870*. Norderstedt 2015 (Reprint of Jena 1906 edition)
- Wilfried Feldenkirchen: *Werner von Siemens. Erfinder und internationaler Unternehmer*. Berlin, Munich 1992
- Philipp Frank: *Theodor Fontane und die Technik*. Würzburg 2005
- Artur Fuest: *Werner von Siemens. Der Begründer der modernen Elektrotechnik*. Fully-reviewed and newly-typeset edition by Michael Holzinger. Berlin 2016 (First edition: Stuttgart, Berlin 1916)
- Benedikt Fuest: »Google hat ein Nerd-Problem.« *Welt*. June 10, 2016
- Cornelia Hegele-Raih: »Leadership?« *Harvard Business Manager*. February, 2004
- Friedrich Heintzenberg (editor): *Aus einem reichen Leben. Werner von Siemens in Briefen an die Familie und an Freunde*. Stuttgart 1953
- Steven Holzner: *Physik für Dummies. Verstehen, was die Welt im Innersten zusammenhält*. Weinheim 2006
- Horst Kant: *Ein »mächtig anregender Kreis«—die Anfänge der physikalischen Gesellschaft zu Berlin*. <https://www.mpiwg-berlin.mpg.de/Preprints/P202.PDF> (October 6, 2016)
- Horst Kant: »Aus den Anfängen der Wissenschaftsförderung durch wissenschaftsbasierte Wirtschaft—Hermann Helmholtz, Werner Siemens und andere.« http://www.wissenschaftsforschung.de/JBo1_129-142.pdf (October 6, 2016)
- Gerhild H. M. Komander: *1881. Berlins erstes Telefonbuch*. Berlin 2006
- Tilmann Krause: »Deutschlands Dichter.« *Welt*. July 13, 2016
- Friedrich Lenger: *Metropolen der Moderne. Eine europäische Stadtgeschichte seit 1850*. Munich 2013
- Wolf Lotter: »Der Sturm und die Windmühlen.« *brand eins*, Book 3. March, 2009, p. 44–52
- Martin Lutz: *Carl von Siemens. Lebenswege*, Vol. 2. Published by Siemens Historical Institute. Munich 2014
- Conrad Matschoss (editor): *Werner Siemens. Ein kurzgefasstes Lebensbild nebst einer Auswahl seiner Briefe*. Two volumes. Berlin 1916
- Daniel Morat et al.: *Weltstadtvergnügen. Berlin 1880–1930*. Göttingen 2016
- Museum of Kommunikation (publisher): *In 28 Minuten von London nach Kalkutta. Aufsätze zur Telegrafiegeschichte aus der Sammlung Dr. Hans Pieper*. Bern 2000
- Thomas Nipperdey: *Deutsche Geschichte 1866–1918*. Vol. 1: *Arbeitswelt und Bürgergeist*. Munich 1990

- N. N.: »Genie und Eigensinn.« Ein Gespräch über die schwierige Geburt des Neuen mit Klaus Fischer (A conversation with Klaus Fischer on the difficult arrival of the new). *brand eins*, Book 1. February, 2003, p. 70-71
- Jürgen Osterhammel: *Die Verwandlung der Welt. Eine Geschichte des 19. Jahrhunderts*. Munich 2009
- Sven Prange: *Massimo Bognanni, Made in Germany. Große Momente der deutschen Wirtschaftsgeschichte*. Frankfurt am Main 2016
- Reinhard Rürup: *Deutschland im 19. Jahrhundert 1815–1871*. Göttingen 1985
- Wolfgang Schivelbusch: *Lichtblicke. Zur Geschichte der künstlichen Helligkeit im 19. Jahrhundert*. Munich, Vienna 1983
- Werner von Siemens: *Lebenserinnerungen*. Edited by Wilfried Feldenkirchen. Munich 2004
- Werner von Siemens: *Recollections*. Edited by Wilfried Feldenkirchen, translated by William Chatterton Coupland. Munich 2008
- Werner von Siemens: *Gesammelte Abhandlungen und Vorträge*. Berlin 1881, http://www.deutschestextarchiv.de/book/view/siemens_abhandlungen_1881 (October 6, 2016)
- Tom Standage: *Das Viktorianische Internet. Die erstaunliche Geschichte des Telegraphen und der ersten Online-Pioniere des 19. Jahrhunderts*. St. Gallen, Zürich 1999
- Werner Stein: *Kulturfahrplan. Die wichtigsten Daten der Kulturgeschichte von Anbeginn bis heute*. Berlin 1946
- Christian Thomas: *Theodor Fontane. Autonomie und Telegraphie in den Gesellschaftsromanen*. Berlin 2015
- John Tully: »A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta-Percha.« *Journal of World History*, Vol. 20, No. 4. December 2009, p. 559–579
- Conrad Wandrey: *Werner Siemens. Geschichte seines Lebens und Wirkens*. Munich 1942
- Sigfrid von Weiher: *Die englischen Siemens-Werke und das Siemens-Überseege­schäft in der zweiten Hälfte des 19. Jahrhunderts*. Berlin 1990



COUNTRY OUTING Werner and Antonie von Siemens on the terrace of the house in Bad Harzburg with their children Carl Friedrich and Hertha (lower-right), circa 1892

ILLUSTRATIONS

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Sammlung von Siemens, Bergisch Gladbach
Siemens Historical Institute, Berlin
wikipedia.de

WERNER VON SIEMENS
CAST OF CHARACTERS

Christian Ferdinand Siemens

1787–1840

Eager, but not always successful father.

Eleonore Siemens

née Deichmann

1792–1839

Werner's dear mother, who sadly dies young.

Mathilde Siemens

née Drumann

1824–1865

First wife and beacon of his life.

Arnold Siemens

1853–1918

Oldest son who should be in touch more often.

Wilhelm Siemens

1855–1919

Second son who should write clear and legible letters.

Anna Siemens

1858–1939

Daughter who should not believe in Darwin.

Antonie Siemens

1840–1900

Second wife and Werner's «tomfoolery.»

Sir William Siemens (Carl Wilhelm Siemens)

1823–1883

Brother who becomes a British citizen and makes an international name for the company.

Carl von Siemens

1829–1906

Brother who runs the business in Russia from St. Petersburg.

Walter Siemens

1833–1868

Brother and Persia expert

Mathilde Himly

née Siemens

1814–1878

Older sister who tries to play matchmaker.

Friedrich (Fritz) Siemens

1826–1904

Brother and gold prospector

Ferdinand Siemens

1820–1893

Brother

Johann Georg Siemens

1805–1879

Cousin and lawyer who has great confidence and invests in the company.

Georg von Siemens

1839–1901

Nephew who later becomes founding director of Deutsche Bank.

Wilhelm Drumann

1786–1861

Historian and father-in-law who helps in an emergency.

Carl Georg Siemens

1809–1885

Technologist and later father-in-law as the father of second wife Antonie.

Marie Siemens

née Freiin von Kap-herr

1835–1869

Carl von Siemens' wife

William Meyer*1816–1868*

Comrade-in-arms, chief engineer, S&H attorney—but most of all, a life-long friend.

Johann Georg Halske*1814–1890*

Mechanic. Businessman and partner who must draw the line somewhere.

Michael Faraday*1791–1867*

English naturalist and experimental physicist who paves the way with his discoveries.

Heinrich Gustav Magnus*1802–1870*

Physicist, chemist, and pioneer of the Berlin Physical Society—and an important networker for the natural sciences in the 19th century.

Emil Heinrich Du Bois-Reymond*1818–1896*

Friend, physiologist, and physician who is just as enthralled by the energy of the new age.

Hermann Ludwig Ferdinand von Helmholtz*1821–1894*

Renaissance man, companion, and most importantly, a great mentor and source of inspiration.

Martin Ohm*1792–1872*

German mathematician and teacher with a very famous brother.

Friedrich Wilhelm Nottebohm*1808–1875*

Prussian government advisor and head of the Telegraph Administration, who seeks fault in the manufacturer—not in the administration.

Heinrich von Stephan*1831–1897*

Champions new communication technologies as postmaster general and Prussian minister.

Ludwig Löffler*1831–1906*

Mechanic employed by Siemens from 1858, valued for his important input on cable-laying projects.

Theodor Fontane*1819–1898*

German writer who is fascinated by technology and creates a literary character very similar to Werner.

Alexander Graham Bell*1847–1922*

Inventor and entrepreneur who does not want to see telephones made in Berlin.

Charles Wheatstone*1802–1875*

British physicist whose invention provides the foundation of it all.

Count Alexander Lüders*1790–1874*

General director of the Russian state telegraph, which brings the brothers to Russia.

Count Pyotr Andreyewitsch Kleinmichel*1793–1869*

Head of the Russian telegraph authority who is swayed by Werner at a crucial point.

Anne Gordon*1821–1901*

William Siemens' wife, and sister of

Lewis Gordon*1815–1876*

British engineer and Newall partner who both support William in England.

Duke Otto von Bismarck

1815–1898

German politician and statesman, who has an open ear for Werner.

Duchess Johanna von Bismarck

née von Puttkamer

1824–1894

Bismarck's wife, who nearly purchases a counterfeit.

Elisabeth of Austria

Empress of Austria

1837–1898

Empress who enjoys listening to Werner.

Franz-Joseph I

Emperor of Austria

1830–1916

Emperor with low approval ratings.

Friedrich Wilhelm III

King of Prussia

1770–1840

Does not want to secede parts of his Berlin garden.

Wilhelm I

King of Prussia, German Kaiser

1797–1888

Not sold on the new technology.

Friedrich III

King of Prussia, German Kaiser

1831–1888

The 99-day Kaiser who adds three letters to Werner's name.

Steve Jobs

1955–2011

American entrepreneur

Mark Zuckerberg

1984–

American entrepreneur, algorithm expert, and communications innovator.

Several Egyptians

Travel companions who receive quite a shock from Werner.

Billy goat from the Caucasus

Finds a new home in Berlin.

Reich dog

Bismarck's Great Dane.

Last, but not least:

**Werner von Siemens**

December 13, 1816–December 6, 1892

«If, after our deaths, someone wants to write a history [...] he will find good material in the letters.»



A MODERN ENTREPRENEURIAL HISTORY
EDITED BY
NATHALIE VON SIEMENS