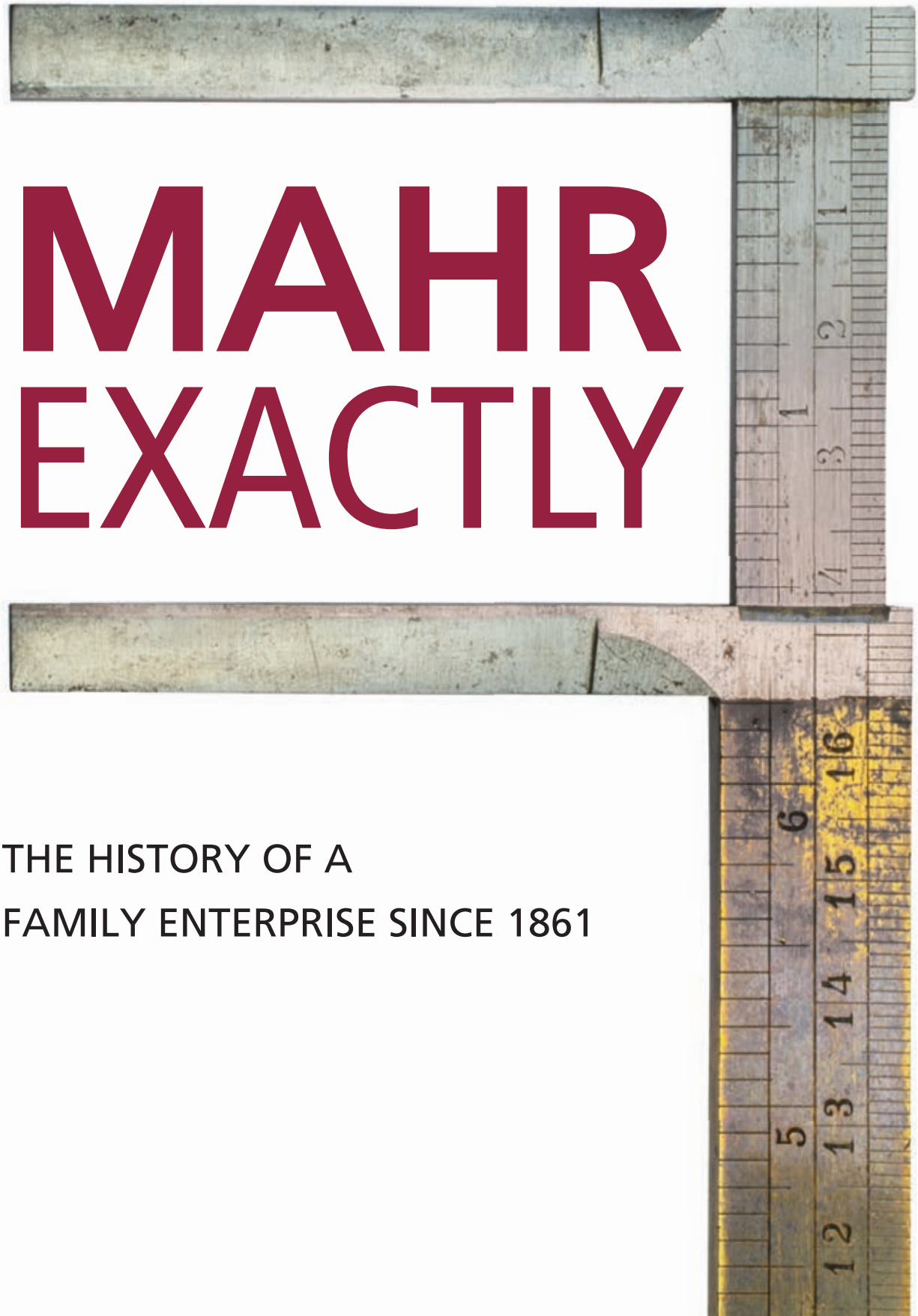
Udo Hinz · Thomas Keidel · Rita Seidel · Jan Strümpel

MAHR EXACTLY



THE HISTORY OF A FAMILY ENTERPRISE SINCE 1861

V&R

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ISBN Print: 9783525301883 — ISBN E-Book: 9783647301884

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Jan Strümpel

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Carl Mahr and metrology in the 19th century

From metalworker to precision machinist

Carl Mahr was born in Mainz, Germany, on February 22, 1830. His father, Friedrich Gottfried Mahr (1795–1864), came from Wiesbaden and was a piano maker by trade. In 1844 he was appointed court instrument maker by Grand Duke Ludwig II. However, this was no lucrative position, simply an honorary title that might help to bring in more work. Young Carl certainly did not enjoy a sheltered upbringing in a musical home. His father was often out on the road, repairing and tuning pianos, and when the boy was ten months old his mother, Eleonore Magdalene (1793–1830), died. Carl and his sister Elisabeth (1823–1894), seven years his senior, were placed in the care of people about whom nothing is known.

Carl was a delicate youth, and the intention was for him to train as a barber. However, he was determined to become a metalworker, and instead took up an apprenticeship with master metalworker Weiß in Darmstadt. We know this from his son Oscar, who also recalled that Carl's "masterpiece", a lock, was awarded first prize – a set of dividers, which were still in use when Oscar went to school. In his early twenties Carl Mahr left his home town, which in those days belonged to the Grand Duchy of Hesse, and moved to Esslingen in the Kingdom of Württemberg to build locomotives.

Railway lines were starting to spread across Württemberg at this time, and in 1845 Esslingen had become the final stop on the central line from Ludwigsburg via Stuttgart. Six locomotives and cars ran on the line initially, imported from the United States of America by ship to Cannstatt. Further expansion, combined with a desire on the part of the kingdom for a domestic rail industry, led to the founding in 1846 of the Maschinenfabrik Esslingen (Esslingen engineering works) by the engineer Emil Kessler. Only local workers were

Factory halls at the Esslingen engineering works in the mid-19th century. The River Neckar is crossed by the impressive Outer Bridge, while Esslingen is located to the left of the picture.

Esslingen

An old photograph of Esslingen, viewed from the "Dicker Turm" tower.

Esslingen was made a free imperial city in the 12th century by order of Frederick I, also known as Frederick Barbarossa, the Holy Roman Emperor at the time. As such, it was answerable only to the Emperor. In 1802 Esslingen was annexed by Württemberg, losing its independence. The population grew rapidly during the industrial era. At the start of the 19th century, some 7000 people lived in the city; by the beginning of the 20th century that number had grown to 27,000. The 1861 census lists 15,059 inhabitants. Since the time of the Reformation, Esslingen had been predominantly Protestant.

The first factories that were established in the industrial era produced mostly textiles and leather goods. There was a textile mill and a glove factory, for example. Up until around 1860 the area was shaped by the metalworking industry, with a number of machine shops and tool factories. While other towns and cities in Württemberg, including the capital Stuttgart, were dominated by commerce, administration or the military, Esslingen was a "factory town". New industrial areas grew. Most of the city walls and several historic buildings had to make way for factories, a telegraph station and a gasworks.

In 1894 Germany's first employment office opened in Esslingen. The workers' educational association established in 1862 soon became the second largest in Württemberg. 1869 saw the opening of the first labor union of textile workers in Württemberg. Up until the First World War, the city was a stronghold of the labor movement in the region.

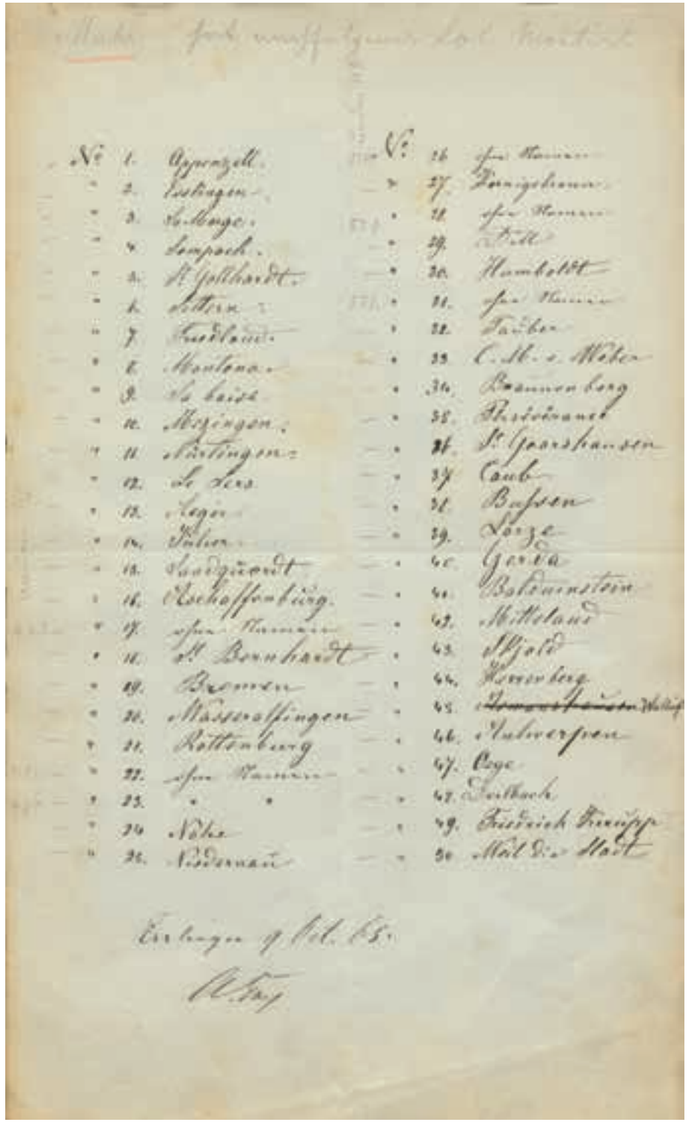
Since the 19th century Esslingen has been renowned for products that are still known today: in 1826 Georg Christian Kessler established the first champagne cellar in Germany – "Kessler Cabinet" is Germany's oldest known champagne brand. Hengstenberg, one of today's leading sauerkraut producers, has been based in Esslingen since it was founded in 1876. The textile company Merkel & Kienlin produced "Esslingen wool" until 1973. And the publisher Schreiber-Verlag, founded in 1831, began to specialize in children's books at an early stage.

ISBN Print: 9783525301883 — ISBN E-Book: 9783647301884

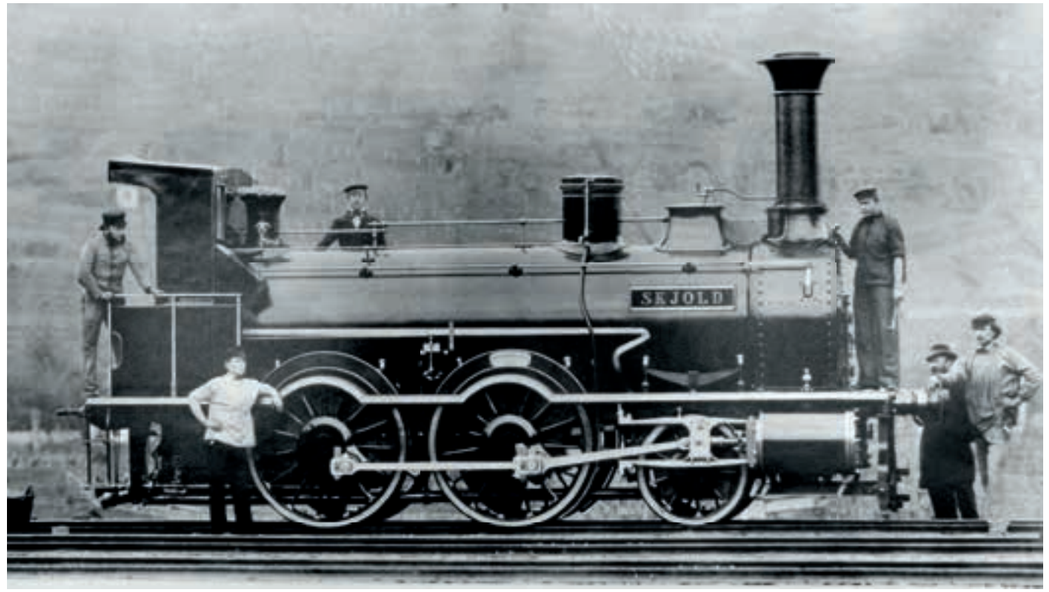
to be recruited initially, because the engineering works was the product of Württembergian economic and trade policy and as such was required to take on employees only from within the region in its early years.

Although the city's economy had been dominated until then by the textile and metalworking industries, the Esslingen engineering works was, from the outset, Württemberg's largest industrial enterprise. It employed almost 500 people from day one, paid the best wages, installed the latest machinery, and already operated a series of workshop units in what was effectively a modern production line system. The first locomotive was completed in 1847, the one-thousandth in 1870. The Esslingen engineering works provided a strong impetus for economic growth and engineering excellence throughout the Neckar region, culminating in the companies founded by Gottlieb Daimler and Carl Benz. After a long and eventful history, Daimler-Benz took over the Esslingen engineering works in 1965 and ended production three years later.

From Mainz on the Rhine to Esslingen on the Neckar is a distance of some two hundred kilometers as the crow flies. Carl Mahr was an "incomer" from a foreign territory. The fact that he was nevertheless taken on as a fitter at the engineering works in 1851/52 is probably due to a lack of



Production list from the Esslingen engineering works, hastily captioned: "Mahr assembled the following locos".



Foreman Carl Mahr – on the left in the cab – and colleagues in 1864 with the newly completed locomotive "Skjold".

skilled labor in the region, especially master craftsmen, and to Mahr's evidently good qualifications. He must certainly have been competent, because he quickly worked his way up: between 1855 and 1865 he served as a foreman, overseeing the assembly of at least fifty locomotives during that time – from the "Appenzell 2" for the United Swiss Railways to the "Weil der Stadt" for the Royal Württemberg State Railways. We know this from a document dating from October 1865, which lists all the locomotives constructed under Carl Mahr's supervision (the corresponding years of manufacture were obtained from delivery notes).

One question: when the name "Mahr" appears in old documents, can we be sure that it always refers to our very own Carl Mahr? Actually yes, very sure. As an outsider, Carl Mahr brought his family name with him to Esslingen. The city's tax registers contain no other mention of a Mahr.

A "Description of the Esslingen engineering works" published in the "Illustrierte Zeitung" of November 1858 paints a very clear picture of Carl Mahr's workplace. "Assembly workshops, 145 feet long, 60 feet wide – The assembly workshops incorporate a gallery on which are mounted a double row of bench vises, several drills and two cranes. – There are currently 13 locomotives in production. The workshops employ 212 people." The factory generally operated six days a week, from 06:00 to 12:00 and from 13:00 to 19:00, i.e, 12 hours per day. A works photograph from 1864 shows Carl Mahr surrounded by his colleagues in the cab of the locomotive "Skjold", commissioned by the Danish State Railways.

Approximately every two months another locomotive would leave the factory, assembled by his team. As the

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man responsible for the accurate execution of all works, Carl Mahr would have had a strong awareness of quality. With rule or calipers in hand, he would have seen evidence every day of the importance attached to the accurate fit of individual parts in a complex machine such as a steam locomotive. At the same time, with an engine weighing many tons, the maximum accuracy that could be hoped for would be half a millimeter. Precision engineering was still a long way off for Carl Mahr.

Nevertheless, he was already considering ways in which production could be improved. In 1863 Carl Mahr filed a patent application with the Central Office for Trade and Commerce in Stuttgart for the invention of a pointed scale rule. "This rule consists of needles encased in wood and with the points protruding; when pressed into the paper of a drawing said needles allow the draftsman to read the rule itself directly." The application was rejected, since Mahr's father had already patented and manufactured a similar device.

As a factory worker and master craftsman Carl Mahr had come a long way, and now he had found his lifelong companion. His proposal of marriage was accepted, and on May 28, 1857 Carl Mahr married Bertha Emma Fuchslocher in Esslingen. Born on May 27, 1833 in Esslingen, she was the daughter of Johann Jacob Fuchslocher, a master tailor from nearby Schorndorf, and his wife Rosine Charlotte. Although Carl would not have been granted a marriage license without proof of certain assets (and without citizenship in Esslingen), to establish a household he needed to borrow some money. The register of pledges for the city of Esslingen records that in 1857 Carl Mahr, "mechanic at the engineering works", borrowed 150 guilders to pay for household furnishings. This sum was repaid by 1870.

The oldest surviving photographs of Bertha and Carl Mahr, taken around 1870.

Soon after the marriage Bertha became pregnant, but their first child was still-born in March 1858. Bertha Mahr would bring six more children into the world, but most of them died young, causing her a great deal of suffering. After Bertha Louise (November 4, 1859), Karl Friedrich was born on March 14, 1861. He died just one year later, on April 3, 1862. Carl Reinhold (November 20, 1862 to April 18, 1882) was not quite 20 years old when he died, while Emil Wilhelm (April 2, 1864 to May 25, 1864) lived for just a few weeks. Then Oscar was born on January 23, 1866, followed some years later by Richard Julius (June 1, 1873 to May 13, 1877), who died at the age of just four.

It was by no means unusual in those days for so many children to fail to reach maturity, but while the risk was ever present, their deaths still represented a succession of blows. For Oscar Mahr, who would later follow his father into the business, the only one of his siblings to play a significant role in his life was his sister Bertha, six years his elder. In 1881 she married Christian Gottlob Lamparter from Reutlingen, clerk to the council in Esslingen, and gave birth to two children. She died on August 1, 1932 in Bischofferode, Thuringia.

Oscar Mahr.

The economy in Germany in the 1850s was gaining momentum. The impetus behind this growth was the expansion of the rail network and the rail industry. At the turn of the 19th century and for some decades to follow, production was still largely on a small scale. People worked in small factories or at home for a putting-out agent, who would organize materials and sell the goods. By the end of the century, around 60 percent of people in employment were working in factories.

Over the course of that period the states and regions that came together in 1871 to form the German Empire experienced a phase of economic growth known in Germany as the "Gründerzeit" (literally, founder's period). It began in 1845 and brought with it many technical innovations. The development of steam-powered machines opened up a whole new set of possibilities for industrial manufacturing, and with the advent of coal and steel, production could be carried out faster, more efficiently, and on a larger scale. Society was becoming mobile: raw materials, commodities and goods could be transported by rail to their place of use just as quickly as people, who to an increasing extent no longer worked in their home environment or for cottage industries. Factory production cut unit costs dramatically; many consumer goods were becoming ever cheaper and more affordable for increasing numbers of people. Although this led to a dynamic growth in consumption, it also meant that entire branches of manual industry lost their economic basis.

To this day we still associate two things in particular with the "Gründerzeit": first, the transformation in urban development, with its legacy of much-loved historic buildings, magnificent villas, and prestige buildings such as museums, theaters and rail stations. And second, the great names of the industrialists who during this time laid the foundations for what would prove to be veritable business empires: Krupp, Schering, Haniel, Siemens, Zeiss, Merck and many more. Away from large-scale industry too, entrepreneurs were establishing reputations that would resonate to this day: Lothar Faber, for example, with his pencil factory (Faber-Castell), or Michael Thonet with his innovative production of bentwood chairs.

In 1861, while Carl Mahr was assembling locomotives, the machinist Fried-

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rich Kübler opened a precision workshop at Kiesstraße 16 in Esslingen. Here he began to manufacture slide calipers and – as yet not folding – rules. Initially he worked alone, though later he may have been assisted by one or two employees. In the 1866 "Directory of the Association of Tradesmen" maintained by the office of the mayor of Esslingen, Kübler is listed as a member eligible to vote, along with only one other machinist.

What was the difference between a metalworker and a machinist in those days? The "Results of the trade survey conducted in 1861 in Württemberg" – the first modern statistical record of its type – sheds some light on this. It distinguished between "Metalworkers, including instrument makers, tool makers, bore smiths, saw makers, nail makers, cutlers, gunsmiths, spur makers, file cutters, instrument grinders and knife grinders", and "Machinists for mathematical, optical, physical objects". So machinists were employed in the service of science, and those in the field of precision engineering who specialized in the manufacture of measuring instruments would frequently, not to say predominantly, count among their customers specialists with specific requirements who made and sold their goods on a retail rather than a wholesale basis.

Friedrich Kübler, who was born in 1816, died on November 6, 1867, and soon afterwards his widow, Christiane Dorothea Kübler, sold the workshop to Carl Mahr. Even a few years earlier this would not have been a straight-forward transaction, because until the introduction of freedom of trade in Württemberg in 1862 the guilds controlled the labor market and could bar anyone from practicing a trade on reasonable or even self-serving grounds.

In December 1867 Carl Mahr made it known through a printed circular that he would be continuing the business with effect from January 1, 1868:

"Esslingen (Württemberg),
December 1867.

I am hereby honored to inform you that I have purchased the mechanical business hitherto operated by F. Kübler, deceased, and focused exclusively to the manufacture of calipers (slide calipers) and rules, and that I shall be pursuing said business on my sole account and under my own name from February 1 next.

Having familiarized myself with these important specialties over sixteen years of employment with the Esslingen engineering works, I hope to satisfy all requirements in connection with this sophisticated field. By commending myself to your kind goodwill, I will seek to justify your estimable confidence in me through the soundness and timeliness of my work, and remain,

Most respectfully yours, Carl Mahr,
Machinist."

The Esslingen engineering works was the most prestigious employer in the region, and in the period around 1865 it was enjoying an economic boom. The fact that Carl Mahr was looking to move in a new direction, leaving the engineering works to set up his own workshop, smacks of adventure and risk, especially for a family man. All trace of Mahr at the engineering works disappears at the end of 1865, suggesting that he may have left the company around this time. In 1867 the unexpected opportunity to take over Kübler's workshop arose. There is no way of piecing together what happened in Mahr's life during those two years and led to this change. What came next is much clearer.

At the start of 1868 Carl Mahr drew up an "Inventory on starting up my business, January 1, 1868". In this book he listed what equipment and materials he had acquired from the widow Kübler: anvils, bench vises, various hammers, dividers and set squares, 80 cast steel files, blocks, pliers, drills, straightedges, eleven punches for indicating gage sizes, a grindstone, a French workbench, and three dividing machines. At a cost of 100 guilders, the most valuable item was a large dividing machine complete with table and case for producing accurate gage divisions – all in all a comprehensive set of precision instruments for which he paid a total of 540 guilders.

Mahr then listed the tools he already owned: a large lathe, two sets of drawing instruments, various files, pliers, saws, screwdrivers, levels and screw clamps. Not a particularly large inventory, and one more suited to joinery, it may have been inherited from his father the piano maker – who had died four years earlier – and was worth a total of 137 guilders (the lathe alone accounting for 100 guilders).

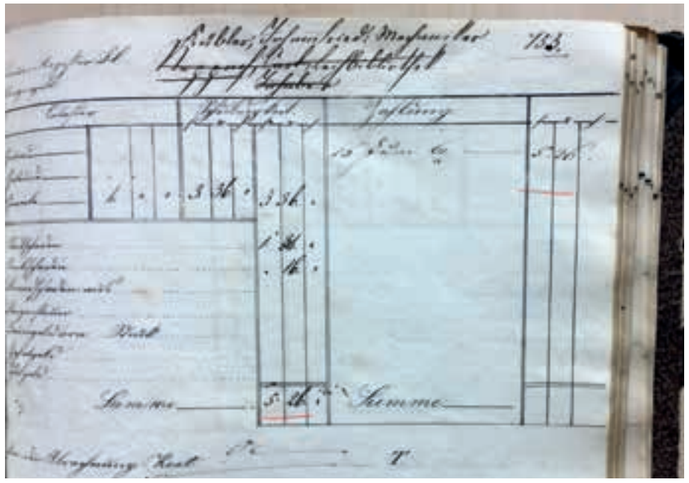
This listing leaves no room for the idyllic image of a factory worker spending his free time tinkering with new ideas, until he sees his opportunity to start up his own business. And yet, in 1868 and at the age of 38, Carl Mahr did exactly that. Not only did he become the owner of his own business, immediately stocking up on new equipment for it, but he also acquired a property. He bought a house on Geiselstraße in the Beutau neighborhood, a cramped and rather poor area of Esslingen at the foot of "Dicker Turm" tower, part of the old fortifications. The impressive backdrop can be seen in a contemporary photograph from the family's collection.

The purchase was documented in the "Esslinger Kaufbuch": "Friedrich Müller, master metalworker from

1861

In Germany the Allgemeines Deutsches Handelsgesetzbuch (the General German Commercial Code) was introduced, the forerunner of the country's present commercial code. – The Börse Stuttgart (Stuttgart Stock Exchange) was founded. – The Scottish physicist James Clerk Maxwell took the world's first color photo. – Philipp Reis invented a machine for establishing an electrical communications link: the telephone. – The first transcontinental telegraph line in the United States of America was completed, replacing what until then had been the world's fastest service for transmitting news: the horseback messenger. – During construction of the Mont Cenis tunnel in the Alps, pneumatic drills were used for the first time. – Abraham Lincoln became President of the United States of America. – The industrialist Robert Bosch, the explorer Fridtjof Nansen, the psychoanalyst Lou Andreas-Salomé, and the pioneering filmmaker Georges Méliès were born.

The Esslingen tax register for the year 1861/1862 included a record for the owner of a lending library, whose name had been crossed out. The machinist Friedrich Kübler took over his register number: he owed trade tax along with smaller amounts to the city and administrative district, amounting to a total of 5.26 guilders. He paid the full amount on June 16, 1862. This simple document confirms the existence in 1861 of the workshop that Carl Mahr would take over some years later. Mahr's name appears in the Esslingen tax register for the first time in 1869/70.



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A view of Geiselstraße in Esslingen, taken from the west. Mahr's house is the building that projects slightly, to the left of the center of the picture.

Esslingen, sells to Carl Mahr, machinist in Esslingen, the building comprising house number 7. A two-story dwelling with two apartments and vaulted cellar on Geiselstraße, together with a large engineering workshop and turning shop behind the house, as well as the courtyard and garden associated with these buildings, along with all appurtenances, for the sum of 3450 guilders. Brühl/Esslingen, December 5, 1868."

He borrowed the full amount of 3450 guilders – his second and last loan – from a Miss Carolina Kessler from Stuttgart and Christian Weber, a toy manufacturer in Esslingen. He had repaid the entire loan by 1877. Some money, 330 guilders, came from the sale of a "tree property" belonging to his wife Bertha – a meadow planted with fruit trees. The Mahr family, which until then had lived on Metzgerbachstraße, moved into Geiselstraße, and Carl also relocated his workshop from the widow Kübler's house to the premises previously used by the metalworker Müller. His life would be centered around this address for the next twenty years.

As a taxpayer, Carl Mahr is listed for the first time in the Esslingen register of taxes for 1869/70 under number 868. The register also contains information about Friedrich Kübler: The machinist paid trade tax for the first time in the accounting year 1861/62. This is the only firm evidence that his business was founded in the year 1861 – at a time when no great formalities were required. Businesses simply started up and, frequently, folded again soon afterwards. Carl Mahr referred to the year 1861 in all brochures, letterheads and other advertising materials for his company: "Established 1861" – even if not by himself. Yet it was up to him to make the business grow and prosper. He had three advantages on his side in this regard: his talent and extensive professional experience, the growing demand for measuring accuracy in an industrial age, and the introduction of the metric system in the German states.

Precision work – the Treaty of the Meter and other standardizations

In the early 19th century it was hard to make much progress along Germany's roads; there were borders and customs houses everywhere. "We've walked full tilt through a dozen principalities, six grand duchies, and a couple of kingdoms, all in half a day," complains a character in Georg Büchner's satirical play *Leonce and Lena*, written in 1836.

During the "French period", following the French revolution and under Napoleon's rule, a start was made on tidying up Germany's plethora of small states. The many small ecclesiastical and secular principalities were incorporated into larger territorial pow-

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Carl Mahr and metrology in the 19th century

Slide caliper, 1860s

The oldest slide caliper owned by the Mahr company was made from steel and brass in about 1868. Two scales on the front measure in millimeters and Viennese inches, while the back is calibrated in “English” and “Rhineland”.

ers, and many imperial cities, including Esslingen, lost their independence. Francis II, head of the Habsburg empire, relinquished his imperial crown in 1806, thereby dissolving the German Empire as an institution. Württemberg was elevated to the status of kingdom and now formed a territory with a much larger area (almost 20,000 square kilometers) and population (some 1,380,000 inhabitants). The German territories now comprised only 39 states (falling to 25 after the foundation of the German Reich in 1871), significantly fewer borders and therefore fewer customs posts and encouraging trade.

Nevertheless, there was still no national German state, and the numerous federal states each had their own currency and system of weights and measures. Nelkenbrecher’s *General guide to currencies, weights and measures for bankers and merchants* (1820) gives an impression of how complicated, confusing and essentially absurd the situation was, even after its reform. It provides details of “Weights and measures according to the new Württemberg Weights and Measures Act of November 30, 1806”. Here is a sample:

“One foot equals 10 inches, each made up of 10 lines, and comprises 127 French lines, i.e., 286.49 French millimeters; it is therefore 8-¾ percent shorter than the Rhineland foot. One rod equals 10 feet. – One Württemberg ell should equal 214.4 Württemberg decimal lines; 100 of these lines or one Württemberg foot is equivalent to 127 French lines, so one Württemberg ell equals 272.288 French lines = 614.235 French millimeters; and 100 Württemberg ells are equivalent to 91.989 Berlin ells or 88.837 Brabant ells or 112.232 ells in Frankfurt am Main or 108.654 ells in Leipzig or 78.830 ells in Vienna. (...) – One cord is 6 feet wide and tall and 4 feet long and is divided into fourths and eighths, each comprising two ells; one cord is equivalent to 98.7839 French cubic feet or 3.3862 French steres or almost one-fourth of a Berlin pile.”

Inch (the width of a thumb), ell, foot, fathom (the distance between the out-

Railway map of Württemberg and Baden from 1867.
The territory of Württemberg is colored green.

ISBN Print: 9783525301883 — ISBN E-Book: 9783647301884

stretched arms of a grown man) – since time immemorial man had been the measure of all things. But with the advent of industrialization, this chaotic situation was proving to be a real obstacle to the development of technology and the exchange of knowledge. Since 1790 the French had been rolling out the metric system as its standard system of units. In 1799 the meter was introduced in revolutionary France, defined as one ten-millionth of the Earth's quadrant on the Paris meridian, in other words one ten-millionth of the distance from the pole to the equator. A platinum gage block of rectangular cross-section was deposited in the National Archives as the "prototype meter".

Casting the international meter bars in Paris. Wood engraving from 1874.

During the 19th century the metric system was adopted by most European countries: before 1815 in parts of Germany under French occupation (in the Pfalz, for example), in 1820 in the Netherlands and Luxemburg, in the 1850s in Spain, in 1861 in Italy, and in 1868 in the North German Confederation. Following the foundation of the German Reich its scope was extended to the whole of Germany. On January 1, 1872 it came into force as an Imperial Act, and from 1876 only the new measures could be used. "Led by the desire to secure international agreement and furtherance of the metric system", 17 countries signed the International Treaty of the Meter on May 20, 1875. Many other countries joined the Treaty over the years. They also agreed on the adoption of the prototype meter and prototype kilogram as units of measurement. Since 2000, the date on which the Treaty of the Meter was concluded, May 20, has been celebrated as "World Metrology Day" (see www.worldmetrologyday.org).

Probably the most important date for Carl Mahr was April 29, 1869. On this date a law was enacted in Württemberg, Bavaria and other states of southern Germany to introduce the meter from the start of 1872. Inches, feet, ells, rods and miles had become obsolete as units of length, as had the countless different definitions in the various states: for instance, a foot in Saxony measured 283.19 mm, in Württemberg 286.49 mm, in Bavaria 291.86 mm, in Nuremberg 303.75 mm, while the Rhineland foot in Prussia measured 313.85 mm. Not to mention the numerous systems of weights and measures outside Germany – at a time when the Celsius scale had already been introduced, temperature was still also being measured in degrees Réaumur and degrees Delisle (in Russia). As for time, the clocks in Cologne showed a different time from those in Königsberg; Central European Time (CET) was only introduced throughout Germany in 1893. Incidentally, a quite different source of clarity also emerged around this time: 1880 saw the first publication of Konrad Duden's *Complete Orthographical Dictionary of the German Language*, which was to become the official standard for German spelling.

Carl Mahr's slide calipers could be calibrated in up to four systems of units. The customer would indicate their preferences at the time of order, for example: "metric, Leipzig, Rhineland, Engl.", or "Bavarian, metric, Paris, Engl.". Carl Mahr was still noting orders in his order book in this way in the 1880s, suggesting that even after the introduction of the meter, local differences in systems of units persisted for quite some time. Nevertheless, people now needed metric rules, and Mahr could supply them:

"Mr. C. Mahr in Esslingen supplied us with the 2-meter standard steel rules required for the various offices of weights and measures in the state following the introduction of the metric system. We are satisfied in every respect with the execution of these items, and we are happy to attest to that effect at Mr. Mahr's request. Royal Central Office for Trade and Commerce, Stuttgart, January 1872."

Carl Mahr actively collected such testimonials and reproduced them in brochures and on leaflets. Right from the outset, what we would now call his marketing strategy was to emphasize the excellent quality of his products and the high level of customer satisfaction. As we have little concrete evidence of his early customer base, these testimonials are useful sources. They also show that he received orders from his former employer, the Esslingen engineering works.

"We hereby attest at the request of the machinist Mr. C. Mahr of Esslingen that following the introduction of the metric system at our factory he has supplied us with our full requirement of rules for workshops and drawing offices. (...) To date we have received from Mr. Mahr approximately 20 2-meter rules, 60 1-meter rules and 500 ½-meter rules, together with a large number of slide calipers; the design was good and aesthetically pleasing, the very deep graduation was in all cases precise and accurate. We therefore have no hesitation in attesting to Mr. Mahr that we are completely satisfied with the items he has supplied. Esslingen, June 1872, Maschinenfabrik Esslingen. Director: Emil Kessler."

The acute need for new, reliable measuring instruments was able to be met and provided a reliable source of business. However, the growing differentiation of the market was accompanied by a demand for greater measuring accuracy, and here Carl Mahr saw his chance to stand out with a range of "specialty" products. At the time this word was used not for specialty food products, for example, but rather –

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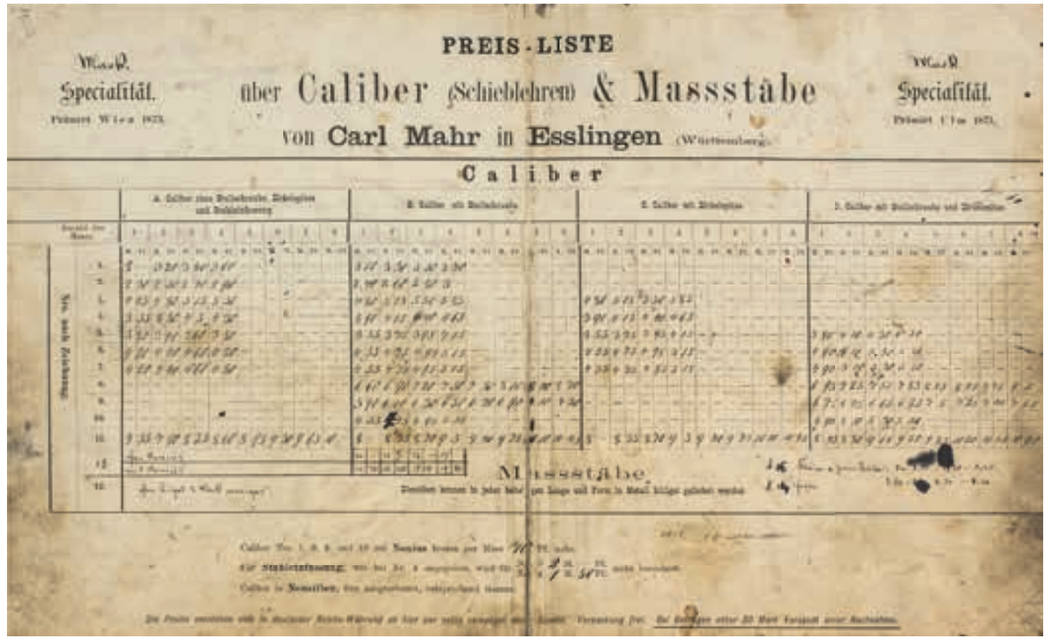
1850 1875 1900 1925 1950 1975 2000

1861 1894


PREIS-LISTE

Specialität. über Caliber (Schieblehren) & Massstäbe Specialität.

von Carl Mahr in Esslingen (Württemberg)

Caliber

A. Caliber zum Schieben, Ziehen und Schleifen | B. Caliber mit Schieber | C. Caliber mit Ziehspitze | D. Caliber mit Schieber und Ziehspitze

Massstäbe

Specialization in slide calipers: Carl Mahr's first price list from around 1873.

according to the German dictionary published by the Brothers Grimm – to describe a "specialism, namely an area of study or business that a person specializes in or has special knowledge of".

Mahr's first surviving price list dates from around 1873. It included four categories of slide calipers: A. Caliper without setting screw, divider tip and steel surround; B. Caliper with setting screw; C. Caliper with divider tip; D. Caliper with setting screw and divider tip. The calipers were available with or without a vernier scale for the precise measurement of one-tenth of a centimeter. A surcharge was quoted for a steel surround.

He offered "nickel silver calipers, finely wrought", naturally "correspondingly more expensive". In general there were four pricing categories, from cheap to expensive. Rules were supplied in wood or metal. Prices were quoted "in southern German currency": guilders (abbreviated to fl. for florin) and kreutzer (kr.), which like the thalers and groats in the north were superseded by the mark (M) following the foundation of the German Reich in 1871 – the "imperial currency" also shown toward the bottom of this price list. Incidentally, the introduction of the mark on January 1, 1876 finally heralded the transition to the decimal system for currency matters too, since until then a thaler had been divided into 30 groats, each worth twelve pennies, and a guilder into 60 kreutzer.

While Mahr may not have had much competition to begin with, competitors soon emerged, including from among his own ranks. In 1874 Carl Stiefelmayer founded a factory in Esslingen that initially specialized in slide calipers; the company still exists

A Mahr tree caliper in use. The photo dates from a later period, but the principle behind the instrument has not changed since it was first developed.

today. In a company photograph taken around 1890 (see page 34), Carl Mahr can be seen sitting next to August Reber, who soon afterwards would open his own measuring instrument factory and would take Mahr's employee Kirchner with him as foreman. In addition, the Georg Reicherter factory, specializing in measuring instruments and testing machines, and especially slide calipers and micrometers to begin with, opened in 1899, again in Esslingen. This made it all the more important for Mahr to emphasize the uncompromising quality of his own products, as in this sales letter dating from around 1878:

"The possession of good, accurate rules is an acknowledged necessity for every railway works, for every mechanical workshop, large or small, and for every drawing office. How many most unfortunate deviations have already been caused by inaccurate measuring rules, in terms of both their overall length and the inaccuracy of their subdivisions.

I have set myself the task of rectifying this abhorrent situation and, being equipped with the most practical facilities, I am in the position to supply, in addition to my slide calipers, rules which satisfy all appropriate requirements. Every one of my rules may be described as a precision rule, yet considering their accuracy the price of my rules is relatively inexpensive.

Should you have a need for such items, may I most sincerely ask you to entrust me with your orders, the proper execution of which you may be assured of, and to recommend me to others as appropriate.
Respectfully yours,
C. Mahr."

Forestry offices numbered among Mahr's most important customers from an early stage. In addition to slide calipers and steel rules in lengths of 500, 1000 and 2000 millimeters, Mahr's range also included tree calipers. These were introduced into the Royal Württemberg Forestry Office in 1863


Schiebleeren
Metallmassstäbe
Gabelmasse
Karl Mahr, Esslingen a./N.

Advertisement in the "Anzeiger für Berg-, Hütten- und Maschinenwesen" (the Mining, Metallurgy and Engineering Advertiser) trade journal of March 2, 1881.

ISBN Print: 9783525301883 — ISBN E-Book: 9783647301884

and could be used to read off the cubic volume of a tree trunk up to one meter in diameter immediately. The forestry director was able to recommend Mahr's iron tree caliper "for its durability, serviceability in all weather conditions, wear resistance and precise measurement". Other satisfied customers included the Wiener Lokomotiv-Fabriks-Aktiengesellschaft in Floridsdorf near Vienna, the Royal Railway Division in Stuttgart, the central workshop of the Grand Duchy of Baden State Railway, and the Royal Iron Works in Wasseralfingen, Württemberg. This last body was in charge of the mechanical workshops that were responsible, among other things, for supervising state and private engineering plants.

Mahr's products were not only widely recommended, they also won prizes: Carl Mahr was awarded the "Progress Medal" at the Swabian Industrial Exhibition in Ulm in 1871 in "Recognition of progress in trade and commerce", a diploma of recognition at the World's Fair in Vienna in 1873, an award in Munich in 1879, and a prize at the Württemberg Regional Trade Exhibition in 1881. Each of his early catalogs bore the message that his work was "award-winning".

A diploma of recognition at the World's Fair, no less! The World's Fair in Vienna in 1873 was the fifth since the inaugural event in London in 1851 and the first to be held on German soil. It was a huge international exhibition lasting for six months and showcasing the latest innovations from industry, the applied arts, and agriculture. Carl Mahr's involvement must have consisted in some of his calipers or rules being displayed as part of a broad selection of similar products. A comprehensive Report on the Vienna World's Fair of 1873 makes no mention of Mahr, although some of his competitors feature: "Worthy of mention as second-order standard meter rules are the standard and double meter exhibited by F. Wilhelm Breithaupt & Sohn from Kassel and the main standard meter bar from Hildebrandt (Berlin). Standard rules were also presented by Froment-Dumoulin, Barbier, Jacquemin-Verguet & Lelièvre of Paris, as well as various other Swiss and German mechanical workshops." These were the competitors against whom Carl Mahr, with his still relatively new company, had literally to measure up.

Mahr's products were displayed at the Württemberg Regional Trade Exhibition held in Stuttgart from May to October 1881, in the "Scientific instruments, clocks, etc." class. The exhibition report briefly mentions those taking part, numbering seventy exhibitors: "Devices and instruments for measuring and weighing (linear rules, precision balances and weights, theodolites, leveling instruments, protractors, measuring tables, dividers) are manufactured in Stuttgart, Balingen, Bitz, Böblingen, Ebingen, Esslingen, Gmünd, Onstmettingen, Tübingen, Ulm, Vaihingen and also in Hechingen and Jungingen (Hohenzollern)." By

Letterhead with crowned heads: Carl Mahr's awards.

Whitworth, Brown & Co.

The British engineer Joseph Whitworth (1803–1887) was at the forefront of the move from manual production methods to standardization, establishing the foundations for mass production. In 1837 he began using round gages with a fixed interference fit and manufacturing finely graduated caliper gages and ring gages. These standard gages were widely used from the 1850s onwards. In 1841 Whitworth devised a uniform measuring system for screws, while in 1856 he developed a precision length measuring instrument with an accuracy of 1/400 of a millimeter. He was also credited with design improvements for lathes.

Largely thanks to Whitworth's work, standardization became the basis for industrial manufacturing. Standardization meant that, in contrast to manual methods, there was no longer any need to check whether the individual parts to be assembled actually fitted together correctly. Provided they were manufactured exactly in accordance with the technical drawing, allowing for tolerances, they could be produced and assembled more efficiently. Series production paved the way for decentralized production processes: companies were able to delegate the manufacture of certain parts to firms which could make them more accurately and cheaply – marking the birth of industrial specialization. As is so often the case, war was the father of all things here, since Whitworth used his developments to manufacture guns like the Whitworth Sharpshooter, one of the first sniper rifles, which was used in the American Civil War.

The American Joseph R. Brown (1810–1876) is credited with the invention of the modern vernier caliper. He was the son in the company Brown & Son, which some years after its founding in 1833 as Brown & Sharpe was on its way to becoming a significant force in the engineering industry, and still manufactures measuring instruments to this day. In 1851 Joseph Brown developed a handy caliper gage that was an essential tool for every metalworker. At the same time he also designed an automatic dividing machine. From 1867 onwards Brown & Sharpe was also the world's leading supplier of mass-produced outside micrometers. Brown's caliper took its name from the movable scale designed to improve reading accuracy, which was introduced in the 17th century by the French mathematician Pierre Vernier.

ISBN Print: 9783525301883 — ISBN E-Book: 9783647301884

Front cover illustration
Slide gage from the 1860s, Mahr Esslingen.
The oldest surviving measuring instrument by Mahr

Rear cover illustration
Measuring a shaft with the MarForm MMQ 400 form tester, Mahr Göttingen.
State-of-the-art measuring station for all form measuring tasks

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ISBN 978-3-647-30188-4

Alternative editions and online services are available at: www.v-r.de

Printed in Germany.
Translation: Arancho Doc srl – Bologna
Typesetting: BEISERT & HINZ Unternehmenskommunikation GmbH, Göttingen / Wiebke Schneider
Printing and binding: Hubert & Co GmbH & Co. KG, Robert-Bosch-Breite 6, D-37079 Göttingen
Printed on acid-free paper.

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ISBN Print: 9783525301883 — ISBN E-Book: 9783647301884