

PROGRESS VERSUS TRADITION – TRADITIONAL CRAFTSMANSHIP AND ATTEMPTS AT INDUSTRIAL TOWER CLOCK PRODUCTION IN THE CZECH LANDS IN THE 19th CENTURY

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ABSTRACT. With the growing need for accurate timekeeping, the demand for clocks on public buildings increased in the 19th century. The only way to meet the demand, however, was to produce individual items by hand. Due to the conservative and protectionist influence of the clockmaker's guilds and the absence of a specialised clockmaking education, technical innovations from abroad were slow to be adopted. Despite this, there are significant innovative watchmaking personalities, such as Josef Božek at the beginning and Václav Krečmer in the second half of the century. There were also several attempts at factory mass production of tower clocks, which, however, were not developed until the 1880s by the company of Ludvík Hainz.

KEYWORDS: History of science and technology, clockmaking, tower clocks, industrial production, serial production, Josef Božek, Romuald Božek, Ludvík Hainz, Václav Krečmer, 19th century.

1. INTRODUCTION – GUILDS AND PRODUCTION OF TOWER CLOCKS IN THE CZECH LANDS

Tower clocks have been built in the Czech lands since the 14th century. Clockmakers, as well as other craftsmen, were organised into guilds since the Middle Ages. For a long time, they were organised together with other metalworkers, such as locksmiths or gunsmiths. It was not until the 18th century that independent clockmakers' guilds appeared. Guilds were important institutions in the medieval and early modern periods, regulating the crafts in towns and playing a key role in quality control and pricing. At the same time, they fulfilled social functions for their members, including the provision of loans, care of widows and orphans, and played a key role in the economic and social life of towns in their time. From the end of the 17th century, the guild self-government gradually declined. From 1708, guild statutes had to be confirmed by the monarch. In 1731, the General Guild Patent was issued, which further centralised the control over the guilds and limited their powers, and in 1739 the General Guild Articles,¹ were issued, which also set the total required apprenticeship period for clockmakers at 4 years, plus additional 4 years of work experience.²

¹For the text of the general guild articles, see for example the copy of the Furriers' Guild: [1].

²According to the guild rules, a freshly apprenticed craftsman, a journeyman, was obliged to travel and work for 4 years with different masters to gain experience in his trade. This practice was still followed during the 19th century and was regulated by law. The apprentice had to record his individual practices in a so-called journey-book (Wanderbuch in German), which also served as an identity document. See [2].

The decrees of 1765 and 1776, allowing the practice of the trade without guild affiliation and declaring freedom of trade, led to a further weakening of the guilds and a move towards market liberalisation. The guilds in the Austrian Empire did not definitively cease to exist until 1859 with the introduction of the Austrian Commercial Code with its new regulation of crafts, when the clockmakers' guild was subsequently transferred to the trade association of carpenters, glaziers, locksmiths, gunsmiths and clockmakers, established by a decree of the *Governor's Office for the Kingdom of Bohemia (Statthaltereifür das Königreich Böhmen)* in Prague of May 9, 1866 [3].

Throughout their existence, guilds have sought exclusivity and maintained exclusivity of the craft by limiting the number of apprentices and new masters. Thus, the very method of passing on craft skills exclusively from master to apprentice was problematic, resulting in the maintenance of established but often inefficient production processes and design solutions. The guilds were not able to accept new technologies and scientifically based production methods and were unable to give up their monopoly and the resulting protectionism and restriction of competition. Thus, this traditional way of apprenticeship, without any further theoretical study, could not keep pace with the modern vocational training or higher technical education.

2. ATTEMPTS TO ESTABLISH VOCATIONAL CLOCKMAKING SCHOOLS

Despite several attempts to establish a professional clock and watch-making school in the Czech lands

during the 19th century, no such institution was successfully established.

The lack of training opportunities for clockmakers was seen as a cause of the industry's backwardness. In the Statistical Report on the State of Industry and Commerce of 1843, it is stated, among other things, as a prerequisite for remedying this situation:

- (1.) "Establishment of schools or workshops – possibly linked to a technical institute – in which apprentices will be taught theoretically and practically by educated experts; for it is essential that those who wish to practice the horological trade should understand mathematics and physics, know the laws of motion of bodies, and be led to apply these subjects correctly.
- (2.) Apprenticeships for young apprentices in Switzerland, France, and England, the cradles of clock and watch-making." [4, p. 702].

However, the lack of professional training affected not only clockmakers, but virtually all crafts [5]. Its improvement was one of the main aims of the newly established *Jednota ku povzbuzení průmyslu v Čechách* (*Union for the Encouragement of Industry in Bohemia*),³ in 1833, which was founded by the then Highest Burgrave of the Bohemian Kingdom, Count Karel Chotek (1783–1868).⁴ In connection with the establishment of these schools for craftsmen, there was also an effort to provide education for clockmakers, in which the clockmaker Josef Kosek⁵ (1780–1858) was particularly involved. Even though such schools were gradually established not only in Prague, but also in many other cities, specific theoretical and practical horological training was not introduced.

From 1871, the clockmaker Václav Krečmer (1844–1918), who had the opportunity to visit horological

³*Jednota ku povzbuzení průmyslu v Čechách* (*Union for the Encouragement of Industry in Bohemia*), in German *Verein zur Ermunterung des gewerbsgeistes in Böhmen*, also abbreviated as *Průmyslová jednota* (*Industrial Union*), was founded in 1833 on the initiative of Karel Chotek, who was concerned with the promotion of industry, including the education of craftsmen. See [6]. *Industrial Union* also had its own library of technical and scientific literature, which was the only public library in Prague in the 1830s and 1840s, alongside the University Library, and included also works on clocks and watch-making. See [7, p. 44].

⁴Count Karel Chotek of Chotkov and Vojnín (1783–1868), Czech nobleman, in 1826–1843, the Highest Burgrave of the Bohemian Kingdom, i.e. the highest administrator of the Czech lands. In addition to founding the *Industrial Union*, he also contributed to the development of infrastructure in the Czech lands, such as the construction of roads and a horse railway from České Budějovice to Linz.

⁵Josef Kosek (also Kossek) (1780–1858), Czech clockmaker, pupil of Josef Božek, from 1825 clockmaker of the astronomical observatory in Clementinum. He made precise pendulum clocks used for astronomical observations and was the first in the Czech lands to produce clocks with gemstone bearings and a bimetallic compensating pendulum. He also disputed with the guild over introducing innovations [8]. In 1814, however, at the intercession of Count František Libšteinský of Kolovrat (1778–1861), he obtained permission to work as an independent clockmaker outside the guild [9, 10].

schools in Geneva in Switzerland and Besançon in France, tried to establish a vocational school. After his return from abroad, he gave several lectures on his experiences [11, p. 3] and within the framework of the *Industrial Union*, he tried to promote the establishment of a Czech horological school. He offered to teach at the school and to lend his own machinery. He only asked for the necessary premises, which were promised to him. This effort was supported by other clockmakers, such as Ludvík Hainz [12, p. 78] or Jan Kaluš, who in 1874 wrote an open letter to the management of the *Industrial Union* [13, p. 2], reminding them of the promise made 3 years earlier. Despite all the efforts, the school was not established. Krečmer, in cooperation with František Špatný (1814–1883),⁶ at least prepared and published the first German-Czech horological dictionary [14] in 1882.

The first provisional *Apprenticeship Workshop of the Watchmakers' Association* was established in 1905⁷ in Bílkova Street in Prague. It was the basis for establishing the *Professional Continuation School for apprentices in the watchmaking trade* [15, p. 209], [17] in 1913.

In the 19th century, the only watchmaking school in the monarchy was in Karlstein an der Thaya in Lower Austria. It was founded in 1873 in a former stable as a training workshop for the manufacture of wooden wall clocks of the Black Forest type, which had a long tradition in this very place.⁸ In 1875, however, it was transformed into the *K. und K. Fachschule für Uhrenindustrie* and given a new building. In 1878, Kurt Dietzschold (1852–1922),⁹ then only 25 years old mechanical engineer from Dresden, was appointed head of the school. He brought with him the experience from the centre of German watchmaking in Glashütte, Saxony, and managed to bring experts from Switzerland to the school. Reinhold Pilz and Johann Tříska were teachers in the manufacture of large clocks at the end of the 19th century. In a week, the apprentices had 52 hours of practical training and 2 hours of theory. According to the annual report of the school year 1896/97, a total of 60 pupils were trained here, mostly from Lower Austria, but also 6 pupils from Bohemia and 3 from Moravia [19]. However, it should be stressed that although Dietzschold himself was an expert in tower clocks, this specialisation was not practically taught at the school.

In Germany, a watchmaking school was founded in Glashütte in 1877, Saxony, by the Central Association of German Watchmakers. It contributed to

⁶František Špatný (1814–1883), Czech lexicographer and writer, author of dictionaries and other specialized texts in the field of forestry, hunting, agriculture and crafts.

⁷Martínek mentions the year 1906 [15]. See also [16].

⁸The production of wooden clocks began here in 1730. By the mid-19th century, more than 100 families were producing clocks in Karlstein and the surrounding area, and around 140 000 pieces were produced annually [18].

⁹Dietzschold is the author of one of the most important books in the field of tower clockmaking, *Die Turmuhren mit Einschluß der sogenannten Kunstuhren*, first published in 1894.

the unprecedented development of German, especially Saxon, horology, both in the field of small watches that could compete with Swiss production, precision pendulum clocks and chronometers. In the second half of the 19th century, German manufacturers were also among the world leaders in the field of tower clocks.

3. THE PROFESSIONAL LEVEL OF TOWER CLOCKMAKING IN THE 19th CENTURY

Romuald Božek (1814–1899),¹⁰ in his manuscript German-language works *Die neue Stadtuhr* [24] and *Über Uhren und Uhrmeister* [25], [26], which are in the NTM Archives, describes the reasons of the low professional level of tower clock makers in the mid-19th century.

He points out that even successful watchmakers often lack the necessary theoretical knowledge and interest in professional study, leading to design errors that contradict theoretical principles. He explains that watchmakers then merely copied what they have seen without understanding the technical rules, and thus remained mere imitators.

“The apprentices are mostly the children of poor parents who are forced to let the boy learn a trade, the sooner the better, so that he can support himself as soon as possible. He can, therefore, only attend such schools in his youth as will teach him to read and write before he is sent at once to apprenticeship. If the master does not then use him to look after the children and to run household errands, which unfortunately happens all too often, especially in the early years of apprenticeship, then at best he learns, through acquired manual skill, to copy the parts of a clock as accurately and cleanly as possible, as he sees it from the journeymen and from his master, without actually knowing whether they could not be made more efficiently. But who is to teach the apprentice these important rules for the rational manufacture of clocks when even the master does not know them? The apprentice thus becomes a scientifically ignorant craftsman without an exhaustive correct assessment of what he has made because he completely lacks the necessary knowledge of the theoretical rules. He remains a manipulator. This thorough knowledge is, therefore, lacking in all watchmakers who have not mastered the technical rules of watchmaking in addition to manual dexterity. After his apprenticeship, he becomes a journeyman, receives a week’s wages, and then has even less desire to study the technical

rules of design science on his own initiative because, after a cramped apprenticeship period, the longed-for freedom has arrived for him, which he then tries to make the most of. The meeting of a woman of the same status as himself often leads to marriage, and he then tries, often with little means, to become independent and though no difficulties befall him in spite of the support of his family, he is then left with even less time and inclination for scientific study, which even seems to him unnecessary, especially as his business operates without him, so long as he is a diligent copyist of what he has seen and learned to imitate in his teaching and as a journeyman.” [25]

Božek then goes on to criticise the quality of the work of most Prague watch and clock makers, accusing them of design errors resulting from their outdated approach and lack of vocational training. In particular, he criticises František Summerekker in connection with his new city clock placed in 1858 on the tower of the Old Town Waterworks. Thus, in 1857, there was a duel between Božek and Summerekker¹¹ in the press, where he reproached him for the lack of robustness and the size of the clockwork, which, according to him, is not able to withstand the weather, which negatively affects the operation of the clock, and points out the problematic use of lantern pinions with thin rotating bars and the use of square-shaped bearings, which he considers to be an obsolete practice completely contrary to the design principles applied in mechanical engineering. Summerekker, on the other hand, accuses Božek of his lack of practical experience and of theorising in vain. In some cases, he was right. Indeed, the empirical solutions of craftsmen for tower clock movements, which are much slower turning machines exposed to adverse environmental conditions and irregular servicing, resulting, for example, in greater contamination of lubricants, are different from those for fast-turning machines in more favourable factory conditions.

Tower clock making in the Czech lands thus lagged in terms of the contribution of its own innovations but also in terms of the adoption of foreign inventions and technologies. The tremendous development that was taking place in the field of precise timekeeping, especially in England and France, and in the field of small watches, especially in Switzerland, hardly touched the

¹⁰Romuald Božek (1814–1899) Czech engineer and inventor, second-born son of Josef Božek. He was particularly successful in the water-works industry and contributed to developing the water supply infrastructure in Prague. He was involved in many other areas, from theatre technology to railroad car design. However, his own entrepreneurial activities failed. He was more of a theoretical horologist than a practicing clockmaker, producing only a few experimental clocks. However, he should be credited with the design of the external chronometer of the Old Town Astronomical Clock [20–23].

¹¹František Summerekker (also Franz Sumerekker or Summerrecker, 1802–1891), an important Prague clockmaker, lived and worked in the Lesser Town in a house near Chotek’s Palace. As he states in his dispute with Božek, he produced more than 100 tower clocks by 1859. In addition to the clock at the Old Town Waterworks Tower, he also built the clocks at the Church of St. Nicholas in Horní Brusnice, the Klára Institute for the Blind, the Church of St. Peter and Paul in Březno near Chomutov, many other churches and town halls in Bohemia, and for the church in the present-day Romanian town of Bystritz or in Totmieder, Hungary (now Palárikovo, Slovakia). His clocks from 1848, with the square bearings and lantern pinions with rotating bars, are on display at the town hall in Chomutov. His workshop was taken over by the Dvořák and Pšross company, which expanded their production to include electric clocks and telegraph instruments.

Czech lands, but basically the entire Austrian Empire. In the case of maritime powers, such as England and France, the need for accurate timekeeping was mainly due to the need for marine chronometers for navigation and, given the desire to gain superiority at sea, had considerable state support. Technical advances in the field of smaller clocks and chronometers were thus carried over into the manufacture of tower clocks.

Another aspect was the size of the market and the fact that tower clocks were mostly municipal investments.¹² Thus, the local origin of the manufacturers played a role, and we can see that their activities are predominantly regional in nature. Clocks were also made by local locksmiths and blacksmiths, who often produced only one piece in their lifetime. Thus, at least in the first half of the 19th century, the demand for tower clocks was largely met by local artisan production.

4. TOWER CLOCK MAKERS AND THEIR PRODUCTS

A characteristic feature of artisanal clockmaking is the uniqueness of the individual pieces. Although clockmakers were able to produce up to several hundred tower clocks during their careers and to supply more than ten pieces a year during the periods of peak demand, no two pieces are usually the same. Probably, in addition to the manufacturing processes and technologies used, the honour of the craft itself, tradition, and the original guild rules dictated this. The craftsman was convinced that the customer deserved his own custom-made work, not a piece that someone else had already received. Thus, tower clocks were made for a specific customer and a specific place.

Individual clockmaker's styles are often distinctive. Although the overall construction and details of one author's clocks are similar, the dimensions, sub-arrangements, and individual parts differ and are usually not interchangeable with parts from different clocks, even if they are of the same type. The use of decorative elements that do not have any essential function is also typical.

Clockmakers were limited by their means of production, and so clock frames were made almost exclusively from wrought iron or, in the second half of the 19th century, steel, although no longer by blacksmithing but by locksmithing from factory-made rolled profiles. The clock wheels were made of brass, bronze, or iron; lantern pinions were usually used. The use of cast iron was beyond the production capabilities of artisan clockmakers and only appeared in the second half of the 19th century, when it was possible to have cast iron parts made to order in specialised foundries.

¹²Large public clocks were traditionally placed on churches, town halls, and town hall towers. However, these were mostly municipal, not ecclesiastical property. The church merely provided the space on the tower for their placement but was neither the owner nor the purchaser, although it may often have contributed to the financing.

Even though at the time of the greatest demand, associated especially with the building boom in the second half of the 19th century, the production of a single manufacturer could reach even tens of units per year, it was still not enough to introduce mass production.

A typical representative of the late craftsmanship of tower clocks is the clockmaker Jan Prokeš (1818–1890) from Sobotka [27]. He supplied well-crafted handmade clocks mainly to the wider area of Sobotka, but he was also able to export abroad, for example, to the Romanian Banat. He competed mainly on price, producing up to ten pieces by hand with a few journeymen and apprentices, including his sons. His total production is estimated at more than 400 pieces, of which several dozens have survived to the present day, many of which are still functional and in their original location.

Alongside this traditional craftsmanship, however, clockmakers with an innovative approach, including several attempts at the industrial mass production of tower clocks, have been around since the very beginning of the 19th century.

The first and most important innovator in the field of tower clocks would be the famous Josef Božek (1782–1835), who worked as a mechanic at the Polytechnic Institute in Prague under the direction of František Josef Gerstner (1756–1832)¹³ where he was mainly engaged in the making of mechanical models for educational purposes and also built over 40 different clock escapements,¹⁴ including escapements of his own design. He was also a practicing clockmaker, and besides his work for the Polytechnic Institute, he also worked independently making clocks, both large tower clocks and interior clocks, including precision pendulum regulators and portable chronometers. He also built a precision clock – an astronomical regulator – for the observatory in Prague's Clementinum. Even in his person, one can see the backwardness and protectionism of the clockmakers' guild. Even though he was a trained clockmaker (he apprenticed under the clockmaker Peter Heinrich¹⁵) he was not a member of the guild. Because he made and sold clocks beyond the needs of the Polytechnic, and especially because he introduced new innovative designs, the guild tried to enforce a ban on his activities. It was only after an intervention from the Viennese court that he was allowed to make clocks again [8].

Josef Božek pioneered the use of the Graham and the Lepaute escapements, which greatly improved the

¹³František Josef Gerstner (also Franz Joseph Gerstner, since 1810 Ritter von Gerstner) (1756–1832) mathematician, physicist, engineer, designer, founder, and professor of the Royal Czech Estates Technical School in Prague, later the Polytechnic Institute, predecessor of today's CTU.

¹⁴Models of escapements and other mechanisms are now in the collections of the National Technical Museum in Prague, for their inventory, see [28].

¹⁵Petr Heinrich was Prague clockmaker at the turn of the 18th and 19th century. Biographical data are unknown. His son, Petr Heinrich born in 1796, was an important manufacturer of flute clocks.

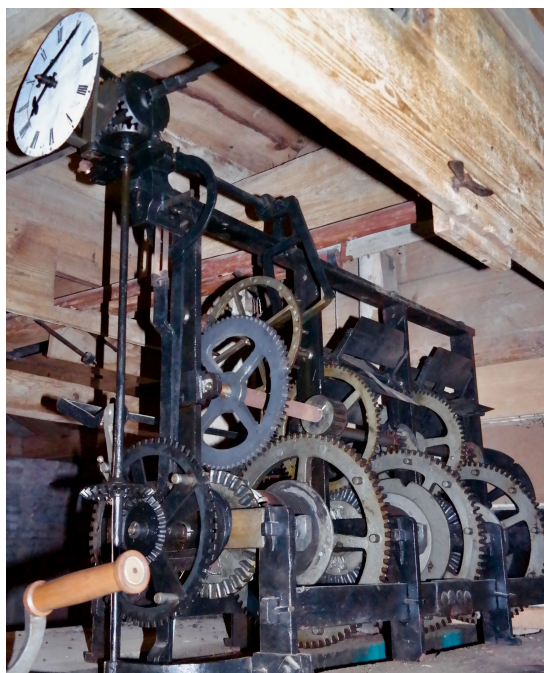


FIGURE 1. The only known surviving example of an cast iron clock designed by Josef Božek at the Prague Polytechnic in 1810 located at Křivoklát Castle, Central Bohemia [29].

quality of the tower clocks. His innovations included improvements to the gears, which led to better durability and stable operation of the clock. He used machine manufacturing techniques, including the use of solid leaf pinions instead of the traditional lantern pinions used since the Middle Ages. His work was praised by the Emperor Francis I, and his clocks, like those in the White Tower (Bílá věž) in Hradec Králové, are considered exemplary works. The clocks for the Prague Provincial Penitentiary (Pražská zemská trestnice) and the Invalidovna (war veterans' dormitory) are also important.

The Polytechnic Institute itself was also important for the development of the technology, engineering, and crafts, including clockmaking. In Professor Gerstner's lectures on Mechanics [30], the rules for clockmaking were also discussed. Students were introduced to new escapement solutions and, thanks to Božek's models, they also learned about the production of different pendulums and the rules for compensating their thermal expansion. They learned about different forms of gearing and the applicability of mechanical engineering techniques to clockmaking in general. Josef Božek's son Romuald himself completed two years of the polytechnic under Prof. Gerstner, although, through no fault of his own, he was unable to finish the school. From his position as a professionally educated mechanic, he was offended by the ignorance of the Prague clockmakers. He recommended to the clockmakers that if they did not have the opportunity to study at the polytechnic, they should at least have become acquainted with his father's models.

5. ATTEMPTS AT FACTORY PRODUCTION

The very first and ground-breaking endeavour, even in the wider European context, to mass produce large clockworks by casting in 1810 is also connected with Josef Božek and Prague Polytechnic. Similar attempts involving the casting of not only parts of the frame, but also wheels and pinions, do not appear in England or France until around 1830, although cast iron for clockwork frames had been used there since the end of the 18th century. Josef Božek, probably under the direction of Gerstner, designed a clockwork of modern construction and produced the brass models, which were used for the mould making at the foundry in Komárov, Hořovice, in the school workshops. This foundry was owned by Count Vrbna,¹⁶ who also collaborated with Polytechnic on other projects at that time. It was he who brought the first model of a steam engine from England and presented it to the school. From the newspapers of the time we know [4, p. 701], [31] of four prototypes, two of which were delivered to Vienna, one of which was used at the Vienna Polytechnic [32] and one of which was placed directly on the building of the Prague Polytechnic, in today's Husova Street [33, p. 226]. Production continued until the 1830s, when these tower clocks are mentioned in the report for the Exhibition of Czech Handicrafts in 1836 [34, p. 40], but we do not know how many clockworks were produced in total or how commercially successful the project was (see Figure 1).

In the 1930s, a similar attempt was made by H. A. Luz [35], the founder of the later First Brno Machine Works, who knew the cast iron clock according to Božek's design but used his own, in his words better construction. It is not even known how many pieces were produced, we only know about the clocks for the old Brno town hall and Luz's own factory [36, p. 855].

In the second half of the 19th century Prague, like many other European cities, experienced a period of building boom. This boom was not limited to the historic centre, but also extended to newly emerging districts such as Vinohrady, Žižkov and Karlín. In these areas, not only residential buildings were built, but also many public buildings and churches. Important architectural gems of the time include the Church of Saints Cyril and Methodius in Karlín, the Church of Saint Ludmila in Vinohrady, and the Church of Saint Procopius in Žižkov, which were also equipped with unique tower clocks. This building boom survived the crash of the Vienna Stock Exchange and the subsequent economic depression. Many new churches and public buildings were also being built in smaller towns and villages, and clocks were being added where they were missing. The need for clocks continued to grow.

¹⁶Rudolf Jan Count Bruntálský of Vrbno (1761–1823) Czech nobleman, founder of ironworks in Komárová. He was also involved in revivalist activities in Bohemia, and worked at the imperial court in Vienna. In 1804–1823, he was honorary president of the Royal Czech Society of Sciences.



FIGURE 2. Remains of the factory-made clock by Jan Holub and Čeněk Daňek in 1866 on the attic of the Church of Saints Cyril and Methodius in Karlín district, Prague.

In 1865, Čeněk Daňek also attempted factory production in his Karlín factory. He cooperated with the mechanic Jan Holub. Jan Holub was a mechanic and clockmaker who came to Prague from Liberec in 1865, when he was called in as a well-known clockmaker to work on repairing the Old Town Astronomical Clock. After prestigious disputes in the commission for the repair of the clock, Holub did not get a contract of his own but agreed to a compromise that the work would be carried out under the official direction of Daňek in his Karlín factory. Although Daňek de-facto took over the contract from Holub, their relations proved good and their cooperation fruitful. This can also be seen in the letter of recommendation that Daňek wrote for Holub in connection with his offer to repair the Olomouc astronomical clock. In addition to the successful repair of the clock itself and the construction of a new external chronometer with Denison's gravity escapement, Holub and Daňek also agreed to start the production of tower clocks. Holub apparently had big plans. He began to call himself a chronometer manufacturer and registered his products for the World Exhibition in Paris in 1868. Unfortunately, the fruit of this cooperation was the only clock for the Church of Cyril and Methodius in Karlín (see Figure 2), which Daňek himself financed, both as a gift to the community where his company was located, but also, apparently, as an advertisement for the newly prepared production. The clock is massive, with a cast iron plate and spacer frame and cast iron wheels.¹⁷ It was ready for the eventual introduction of mass production and was manufactured by machine. Daňek and Holub soon received another commission, this time to

¹⁷In 2024, the clock is still left in the church's attic, dismantled but probably complete.

be paid by the city for a clock on the Prague Powder Tower. Unfortunately, the Prussian-Austrian War intervened. All investments were cancelled, with them also the contract for this clock. Holub decided to leave Prague and move to Vienna, where he and his brother Eduard began manufacturing sewing machines. He did not attend the Paris exhibition. Without Holub, Daňek did not have the necessary expertise to start the production. This promising attempt at industrial tower clock production ended before it even began.

Václav Krečmer was another very innovative clockmaker who, despite producing many clocks (see Figure 3) and working until the year of his death in 1918, did not achieve real mass production. Nevertheless, he introduced several important innovations. He was the first to use the Denison gravity escapement in a tower clock. He also used cast parts, even for smaller elements, such as the arms of the Denison escapement mechanism. He came from an relatively wealthy landowning family from Hostivař near Prague, and in his youth, he had the opportunity to study in Switzerland and France and learn about technical innovations there. He tried to expand his production and moved it to new premises within Prague several times. Apparently, he also tried to build larger production capacities in the new industrial suburb of Karlín. During his career, he also produced several hundred tower clocks, but he also devoted himself to producing interior clocks. Apparently, he also tried to establish himself in France and England. There was an advertisement in the period press seeking English- and French-speaking trainees precisely for the purpose of exporting to these markets. How successful he was in the end; we do not know. Despite the technical advancement of his products, the surviving pieces show

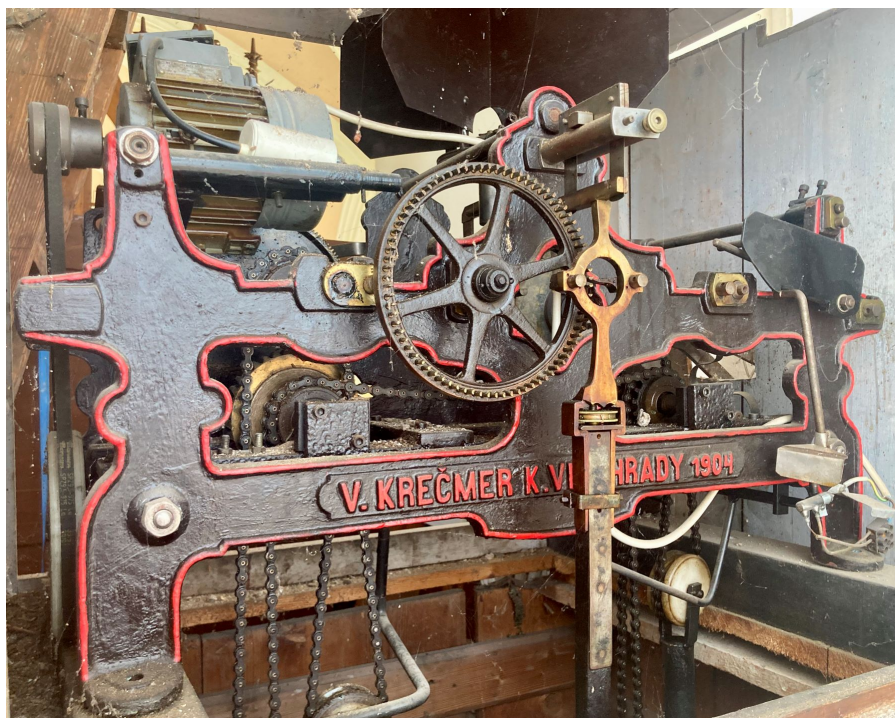


FIGURE 3. Clock by Václav Krečmer from 1904 in the Chapel of the Visitation of the Virgin Mary (Navštívení Panny Marie) in Žďár u Svijan, Central Bohemia with a newly added electric winding.

no signs of any attempt at mass production and are invariably one-off pieces made in a workshop manner. He did, however, use cast iron cast components, clock frames or levers, and anchor arms. He probably had them cast by suppliers.

Among other domestic manufacturers, let us briefly mention at least František Moravus, active in Brno, Karel Adamec, a clockmaker from Čáslav, active after 1883, J. Janata in Poděbrady, active from the 1860s, Josef Kohlert in Kraslice, A. Dvořák in Vyškov, starting at the very end of the century, and Jindřich Grubský in Pečky.

In general, according to the information from the catalogue of the Austrian exposition at the World Exhibition in Paris in 1867, there were 321 manufacturers of large clocks in the whole territory of the Austrian monarchy at that time [37, p. 70].

In the Czech lands, we can only speak of real serial factory production after 1880, when Ludvík Hainz Jr., started producing tower clocks (see Figure 4) in the company's original premises on Old Town Square. In 1890, the workshop was no longer sufficient, and Hainz bought a new building at 619 Dlouhá třída Street and purchased new machinery [15, p. 18]. Initially, the company bought clock parts from Germany but modified them. Later, it started its own serial production.

6. CONCLUSION

The high demand for tower clocks in the 19th century was driven by the growing need for accurate timekeeping and their presence in public spaces, the increasing

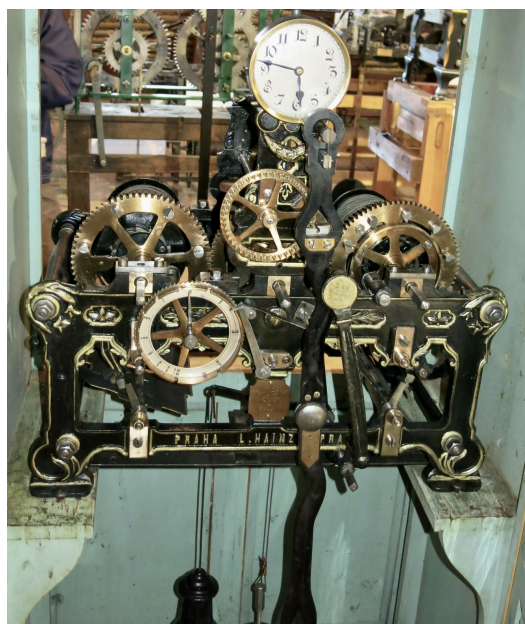


FIGURE 4. Ludvík Hainz factory clock from 1896 in the collection of the Czech Horological Society at the Chateau Děčín.

number of new public buildings, but also by the general desire for modernity and progress. Technical progress was rapid, both in terms of design solutions and with the advent of new materials, especially cast iron, and new possibilities in production technology and machinery, has been rapid. Nevertheless, until the last decades of the 19th century, the manufacture of large clock movements remained in the Czech lands

and throughout the Austrian Monarchy, despite several attempts at factory batch production, mainly hand-made piece production.

One reason was the conservative and protectionist attitude of clockmakers operating within the traditional guilds until the introduction of the Austrian Commercial Code in 1859. This also resulted in the traditional way of training based on the relationship between the apprentice and the master and the resulting persistence in established methods of production and technical solutions. Clockmakers promoting more progressive technical solutions were thus in conflict with the guilds. Throughout the 19th century, attempts to introduce independent clock and watch making training were unsuccessful.

The turnaround came in the 1880s, especially with the start of factory production of tower clocks by Ludvík Hainz Jr.

Nevertheless, the Czech lands were mostly covered by domestic production and local tower clock makers were able to supply other countries of the monarchy, but in some cases even beyond its borders, mostly to the east – to Romania, Serbia or Russia. Despite some attempts, efforts to penetrate western markets, even neighbouring Germany, were unsuccessful. Compared with English, French, and German production in particular, the domestic production was much smaller in volume and, with some exceptions, technically less advanced.

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