

National Exhibition of 1891, designed by the architect B. Münzberger. The iron construction was supplied by the Böhmisches-Mährische Maschinenfabrik in Prague, the predecessor of the modern CKD organisation. The Palace of Industry was expressly erected as the first iron architecture not to use cast iron. The building is in three parts. The construction of the high central section, with its rectangular ground plan 40 m wide and 65 m long with four brick-built corner pylons, is formed by iron lattice arches with a span of 38 m. The front and rear façades are designed as vast glass walls, originally with a brick-built entrance portal. The central part is dominated by the iron tower, 51 m high, with spiral staircases and gallery.

The long, low side wings have a similar iron construction to that of the central main building. The Palace of Industry was rebuilt in 1952-53 for congresses and other social purposes, but the main features of the construction were retained.

In the year of the Jubilee National Exhibition in 1891, an even more original building was erected in Prague, the 60 m high look-out tower on the Petřín hill, a miniature copy of the Eiffel Tower in Paris which was erected in a mere six weeks. The designer was J. Prášil, the iron construction being again supplied by the Böhmisches-Mährische Maschinenbaufabrik.

In the second half of the nineteenth century, cast iron played an important role as the material for monuments and street lamps, often in closest connection with monumental architecture. Particularly in Prague, some very interesting and, from the town-planning aspect, superb examples have been preserved, for instance the lamp-posts for the gas street lighting of 1867, the lamp-posts in front of the main façade of the House of Artists (the former Rudolfinum), designed by J. Schulz between 1876 and 1884, and the lamp-posts on the Mayday Bridge by the architect A. Balsánek, 1899-1901.

In conclusion, it must be remarked that from the point of view of quantity, Bohemian and Moravian iron architecture did not play a great role, something which is a little surprising in view of our large and well-established iron industry. Certainly, the somewhat backward provincial atmosphere of the towns of the time is the reason for this. There were not all that many great building technological and architectural tasks. This only changed radically at the turn of the century.

Despite the restricted quantity of tasks, our iron architecture has produced some very remarkable works. They fit in harmonically and naturally into the wonderful thousand years' development of Bohemian, Moravian and Silesian architecture and, indeed, art as such.

## IRON IN THE HISTORICAL ARCHITECTURE OF THE NINETEENTH CENTURY IN POLAND

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The nineteenth century, the century of steam power and electricity, but above all the century of iron, was a period of history in which Poland did not exist on the map of Europe. Partitioned by the three great powers, Russia, Austria and Prussia, towards the end of the eighteenth century, it ceased to exist as an independent state for over one hundred years, until the First World War. In the century of lost independence, there were periods of relative political independence within the restricted territorial limits of the Grand Duchy of Warsaw at the time of the Napoleonic Wars, or in the Kingdom of Poland created at the Congress of Vienna. Despite the fact that they belonged to three different powers, the ethnic Polish areas of the erstwhile aristocratic republic did retain a unified architectural scene for the most part during the whole nineteenth century. The architecture erected on the initiative of Polish clients, the aristocracy, the gentry, the bourgeoisie and Polish organisations and associations, played the decisive role here. Polish and foreign architects carrying out these works often worked in areas of all three annexed parts of the country. Lying on top of this fundamental layer of buildings erected for Polish investors there was a thin layer of architecture built by the governments of all three partitioning powers. Only in the Prussian part did this also include public and ecclesiastical buildings, in the other parts it was generally restricted to "architectura militaris", especially the fortifications constructed in the frontier areas. As a result, present-day Poland, through whose territory the frontiers between three great powers ran, is nowadays the only country in Europe to possess high-quality monuments of the defensive architecture of the nineteenth century: Napoleonic, Prussian, Austrian and Russian.

The bases for the application of iron in building and architecture in the Polish regions were created shortly after the Congress of Vienna. At that time, the shrewd authorities in the Kingdom of Poland set about building up the iron and steel industry. For this purpose two regions were selected: the so-called "old Polish mining district" (around Kielce) and the Dabrowa area, which both had two thousand years of tradition in iron ore extraction and had for centuries been the main centres for Polish iron production. The construction of numerous new and modern iron foundries in these areas was not just intended to satisfy local needs. They were also intended to serve for extensive iron and steel exports to Russia. The Kingdom of Poland was to become an industrial base for Russia with which it was linked. The energy thrown into the whole undertaking, as well as the individual works, made it one of the largest investments in the iron and steel industry in Europe of that time. The largest industrial foundation, the construction of which lasted until the eighteen-fifties, was begun after 1830. It was an investment by the Polish Bank, a metallurgical combine which arose along a 40 km section of the river Kamienna. The river, which was transformed into a canal and had dams constructed along it every few kilometres, became a gigantic production line, along which the raw material, iron, went through all the stages of its processing in succession. Although these industrial works from the first half of the nineteenth century in general displayed Classicist or Neo-Gothic architectural forms, their importance for the development of architecture and of the building industry in Poland was considerable. From the beginning of the eighteen-twenties

until the First World War, they were the main source of the raw material, iron, which was exported from the Kingdom of Poland into the other two partitioned areas and also into the interior of Russia.

The products of these works, which we know from the catalogues published and which were intended for building and architecture, were restricted to relatively small typical elements, such as staircases, railings, balcony supports, pillars etc., which did not differ from the forms at that time common in Europe. They did not provide architects with any possibility of erecting buildings in iron, but did, however, permit the decoration of the interiors and façades with modern details. Modern, not so much in the sense of the form than the value of the new material which was light and fire-proof. In this way, iron entered into the architecture of the Polish areas in the eighteen-twenties. This architecture was not, it is true, changed, nor was the architects' way of thinking influenced, but it was considerably complemented by small new details. It was the age of experimenting and becoming accustomed to the new material.

One example of one of the earliest applications of iron as a first class component of a façade is the Raczyński Library in Posen (Poznań), an object of great cultural importance for the Grand Duchy of Posen. The founder - Count Edward Raczyński (brother of the art historian and collector, Atanazy, founder of the renowned Raczyński Gallery in Berlin, and author of a three-volume "History of Modern German Art") - commissioned the design from an architect, whose name is no longer known to us, in Rome. The pillard façade draws its inspiration from the well-known Louvre façade by Charles Percier. Raczyński had the library built between 1821 and 1828, after, however, important changes had been made in the design. The stone pillars were replaced by iron pillars cast in Silesia. The change of material did not result in any change in the pillar proportions. The new material thus did not influence the form of the structure, it just remained a technical novelty.

About the mid-nineteenth century, we can observe the shaping of architecture under the influence of the new material. The precursors of this new way of thinking were in the Warsaw group (unfortunately, only in individual cases), the architects Jan Jakub Gay (1802-1849) and Franciszek Maria Lanci (1799-1875). Of the works designed by Gay, an active pioneer in the use of iron detail in architecture, we would mention the (now no longer extant) bazaar, erected in 1841. That was probably the first structure in Poland in which the whole architectural expression was obtained by the introduction of light open-work arches, supported on arcades and iron pillars along the front of the façade. The early death of Gay, who had no successor among the other architects, led to an end of the experiments with iron architecture.

Lanci, who remained under the influence of Schinkel's architecture from the end of the first half of the century on, with whom he had successfully competed in the design of the Golden Chapel in Posen, chose another path in this search. In his work, and also in the history of nineteenth century architecture in Poland, the tenement house erected by him in Warsaw in 1847 (ul. Krakowskie Przedmieście 17) occupied a special position. The façade of this tenement house rests on small pillars set between small iron columns on the ground floor, the proportions of which correspond to the characteristics of the material. Arcade segments were included between the pillars (something which had been introduced seven years previously by Heinrich Hübsch in the pump room in Baden-Baden). On the other hand, the

linear division of the façade of the first and second floors is a continuation of the rhythm started by the iron pillars on the ground floor. There they are continued in the form of slender pilasters, repeating their diameter. Both the iron pillars and pilasters have bases and capitals, the forms of which were taken from classical architecture, but their proportions were already divergent from the latter and peculiar to the iron skeleton. The whole façade gives evidence of the search for an ingenious compromise between the new material here being exposed in a prominent part of the city and the classicistic principles of composition. This compromise - if it had been found - would have been able to save the architecture of the second half of the nineteenth century from the tragic division into an architecture erected by professional architects with aesthetic aspirations and a building industry aiming at utilitarian purposes, which became the domain of engineers. Unfortunately, Lanci did not continue his search, and it was not taken up by other Polish architects. In the architecture of the second half of the nineteenth century, iron elements were employed to an ever increasing extent; numerous iron structures were also built, e.g. railway stations, market halls, garden structures etc., on the other hand, in the field of the application of iron in architecture, no values were set which could bear European comparison. Meanwhile, iron soon gained its *raison d'être* in the field of engineering, especially in bridge and railway construction (the opening of the Vienna-Warsaw railway in 1848). Polish engineers were also often active abroad, particularly in Russia (the first fixed bridge across the Neva in Petersburg was erected by the Polish engineer Stanisław Kierbedź). The main technical problems in the field of bridge construction in Poland itself were centred on linking the two banks of the Vistula in Warsaw. The designs presented here give proof of the European standard of their authors' engineering skill. The architect of the first project was the engineer Ludwik Mentzel (1764-1848) who was in charge of works connected with transportation in the Kingdom of Poland from 1816-1833. In 1820 he prepared and published in the press (*Gazeta Warszawskie*, 7.III.1820) the design for a chain suspension, cross-bearer bridge. The architect wanted to span the roughly 650 m breadth of the river with five spans of 130 m length each; the bridge was intended to be 11.8 m in width. These were imposing measurements, without comparison in the bridge construction of the time. The special feature of the bridge was the mounting of the chains beneath the carriageway. The project was given positive technical evaluation, but was, nevertheless, not approved by the council of building engineers of the Kingdom of Poland. The councillors shrank back from the idea of a construction which had never been previously tried in the world, namely one supported on chains slung beneath the carriageway. The official arguments against this design were the building costs and the economic difficulties of the Kingdom of Poland. The project was thus dropped. It should be added that a modern check on the calculations of this design has confirmed its correctness. The subsequent designs for railway bridges in the eighteen-thirties by the engineer Feliks Pancer (1798-1851) were also not carried out. Not until 1859-1864 was a bridge constructed by the engineer Kierbedź, which was of a light and, for that time, modern, lattice-work, with the track bed in the interior. Similar lattice-work bridges for both road and rail were erected in the second half of the century, whereby the traffic was either carried inside the lattice-work or on top of it.

It is noticeable that at the beginning of the second half of the nineteenth century, the engineers were still more or less showing a tendency, when designing structures, to form these, on the basis of traditional understanding, as "architectural works". Architecture, namely, occupied a position based on thousands of years of tradition, whereas the art of those engineers working with the new material, iron, was still trying to find its appropriate place. The engineers were thus also searching, even if for different reasons, for that same compromise between the regularity of the new material and the aesthetic criteria prevailing at the time, just as the architects, including Lanci, were doing.

In the second half of the century, it became clear to both sides that such a compromise did not exist. The paths of architecture and the art of engineering had separated. But, as the architects, still keeping to their standpoints, only furnished and decorated the interior of their structures or the façades with the help of iron detail work, with predominantly historicising forms, showing in this way their attitude towards the new material, the constructors logically followed the voice of this material and extracted all the technical possibilities they could from it. However, both sides must have felt dissatisfied, because at the beginning of the twentieth century (1904-1914), when it was proposed to erect a further bridge across the Vistula, there was also an architect among those submitting projects. However, what was achieved by this cooperation in the final effect? A clear construction of the iron arched bridge, and an architectural pendant, flanking the bridgeheads, in the form of galleries and turrets in so-called Polish Neo-Renaissance style. Instead of a unified whole, all that was achieved was co-existence.

The problem of the role of iron in the architecture of the nineteenth century on Polish territory still requires more thorough investigation. Only on the basis of this is it possible to produce a more profound, synthetic version. Nevertheless, this will certainly not change the general opinion which tends towards a historical paradox. In world architecture, the first half of the nineteenth century was a period of iron which became commonplace in the second half of the century. The great achievements only came in that latter half. In the Polish territories, the period of trial and error was much more interesting; the building up of the modern iron and steel industry, the early introduction of iron details in architecture, Lanci's quest, the bridges by Mentzel, Pancer and Kierbedź are facts worth mentioning on the side-lines of the history of the application of iron in Europe in the nineteenth century. In the second half of the century there is a lack of such features. This situation is easily explained by the political-economic situation. In the first half of the century, the Polish areas were able to keep in step with western Europe in the process of the "Industrial Revolution", and the relative freedom prevailing within the annexed parts of the country provided the possibility of development for culture and technology. The increasing repression of the second half of the century on the part of the partitioning powers (the efforts towards Russification in the Russian annexed area and towards Germanisation in the Prussian one), the impoverishment caused by the successive revolte, brought about a economic backwardness in the country which was to last until the outbreak of the First World War. There were no conditions for undertaking large investments in the form of iron and steel construction. There was also a complete absence of any ideological motivation. The threat to national survival concentrated the architects' attention

particularly on the forms of historical architecture which were considered to be characteristic for Polish culture. Drawing on these forms, working with historical detail had a political implication because it stirred the feeling for national identity. Iron also fulfilled its task in this field as a detail with historic forms. On the other hand, it did not fulfil this task in the form of modern constructions without any links with the history of their own or a foreign architecture. Therefore, the bridgeheads of the new bridge in Warsaw had to have Renaissance roofs borrowed from the architecture of Cracow. The bridge thus became a symbol of the link between the modern world and national tradition.

Only the independence attained as a result of the First World War brought about a change in the emotional attitude and the development of an architecture with modern forms. In the first post-war years, particularly at the faculty of architecture at the Technical University in Warsaw, studies were undertaken on the possibilities of the use of iron in building. They resulted, among other things, in the construction of the first welded bridge in Europe. It was erected in 1924, not far from Warsaw as the work of Prof. Stanisław Bryła.