KÖNIGSHÜTTE OF BAD LAUTERBERG - A BUILDING PARALLELING SAYNER HÜTTE

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Königshütte at Bad Lauterberg in the Harz Mountains, which was built in the late twenties of the 19th century, was one of the most important ironworks and production sites of heavy industry in the Kingdom of Hanover. In 1977, some plans and documents were found in the legacy of its builder, Karl Heinrich Mummenthey, who had been the planning engineer and builder of the works.

Königshütte was rebuilt on the site of older ironworks (1). The wish of the Kingdom of Hanover to have an independent, capable iron producing plant close to the mines in the Harz Mountains to back its mercantilist economic policy, which facility would have to be able to turn out not only products for daily use, but large quantities mainly of machines, weapons and material, had been the reason for building this plant. The government-controlled works managed by the Mines Inspectorate in Clausthal-Zellerfeld showed a continuous upward trend; new facilities were added (2); the expansion of the plant was largely completed in 1830. We know about the ironworks also from a description by Freiherr Edmund von Berg, who was full of praise and enthusiasm: "The main building of the new blast furnace facility was completed in 1830. Entering the beautiful ironworks square from Lauterberg one sees on the extreme left a small house for workers, beside it an area for the loam moulding works. On the far left hand side, a truly royal plant has been erected in beautiful Gothic style, the blast furnace building where the iron ore is smelted and in the hall of which we see the shops of the skilful moulders. On both sides of the ironworks there are refining hearth iron hammers, and behind them the iron magazine and a coal bunker...." (3). The buildings of Königshütte remained almost unchanged up until 1861. In that year, the works were acquired by the industrialist Carl Peters and the publisher Ludwig Holle of Wolfenbüttel; the ironworks have remained an iron smelting plant to this day which is presently operated as a private company (4).

Plan 1 (5) is an overall view from the west. Since the building was erected on a slope, favourable conditions resulted for the transport of the material to be smelted and the additives. One way from the east leads over a ramp into the coal bunker with the basement and the ore magazine. In the central axis of the building there were one door and one window opening with pointed arches, respectively, on each floor. On both sides of these dominating openings round windows with inscribed cinquefoils admitted light to the interior. A steep double pitch roof with steep gables covered the shed, which is a truly expensive piece of architecture to design for a mere storage facility for raw materials.
North of the shed the ramp is continued and underpassed by a way leading under a bridge with pointed arches. Finally, the ramp terminates in a section of the building the basement floor of which contains the furrow drain and the undershot waterwheels under a pointed barrel vault structure. At the level of the ramp there is a building facing in the north-south direction with a double pitch roof and two window axes which probably served as a deposit for the burden.
This complex, which was constructed close to the slope for better and easier materials transport, is followed by the blast furnace and refining hearth areas. The latter consists of the blast furnace

arranged in the longitudinal axis of the building and two buildings situated at right angles which accommodated the refining hearths, the ore stamp mill and the blowers for the blast furnace. The rectangular blast furnace tapers off to an octagon in its upper structure, decorating the furnace throat with round orifices and a tracery balustrade of cast iron. The throat is higher than the ridge of the burden storage facility. Only the western front wall is now recognizable among the buildings of the refining hearth system. Two rows of windows are visible above the continuous base; three openings with pointed arches admit light to the workshops; above them there is another one in the central axis, two round windows with five window areas on the side of the axis light the attic. The cornice accompanying the steep gable is particularly emphasized.

The next building following north of the blast furnace is a short intermediate wing connecting with the three-apse building of the moulding works. The apses each consist of seven sides of a dodecagon; the eastern and western apses are merely one-storey buildings with a row of windows with pointed arches, but the northern apse has two storeys: above the windows there are closely spaced rows of double-light windows with pointed arches behind which there is a narrow, yet accessible passageway, much like a medieval miniature gallery. The northern apse is as high as the ridge of the intermediate wing, the roofs of the other two apses are slightly lower.
This plan differs from the actual building in some important respects. It will therefore probably have to be regarded as a preliminary draft already including the basic concept, but implemented differently in some details, such as the tracery, the furnace throat and the intermediate wing of the building, which was finally made of cast iron. Mummenthey described each part of the building and each building structure in detailed drawings. Especially plans Nos.5,9 and 15 are of interest for our subject.

Plan No. 5 shows the front of the blast furnace on a small scale; on this side the blast furnace has a tap hole with a pointed arch and a multiply terraced cover, and cast iron corner columns in the recessed corners facing towards the side rooms, all of which features can be explained solely by aesthetic reasons. These corner columns can be seen much more clearly in plan No. 5: they were octagonal and had blade capitals and bases in the late Gothic style. Also the square blast furnace superstructure with the octagonal furnace throat, the round windows with the double slanted window jamb and the stepped tap hole are visible in detail. On the left, part of the refining hearth building and a view of the roof structure can be seen. The plan is signed by Mummenthey and dated Claustahl, March 9, 1828 (6).

Plan No. 9 is undoubtedly the most informative document: it shows the intermediate wing between the blast furnace and the refining hearth buildings in the south and the moulding shop in the north. The drawing contains a cross section, a plan, a pencilled elevation of a staircase, the western view and a longitudinal section.

The first striking observation to be made concerns the fact that the intermediate wing was made of iron. The choice of this material can be explained from the function and location of this part of the building in front of the blast furnace tap hole, a component which could easily have caught fire, had it been built of wood.
The upper cross section shows the iron roof structure in front of the view of the blast furnace tap hole. The intermediate wing has three naves with a basilica-type cross section, because the nave, if this is what it can be called, receives light through a very low upper loft zone above the supports. The intermediate wing rests on iron

pillars which are relatively thin, like the corner columns on the blast furnace, equipped with blade capitals and octagonal bases, all identical, as is proved by the few columns that have been preserved. Swivel cranes of the type found in Sayn did not exist in this facility. The "aisles" are two-storey buildings, due to the installation of stage platform-like intermediate floors, emphasized by a sophisticated gable portal crowned by a cross. There are double-light tracery windows and spandrel quatrefoils. In the western aisle there is the drying oven, the eastern aisle holds the two cupola furnaces. Flights of iron stairs interrupted at right angles and running along the inner walls of the aisles lead to the intermediate floors from which the two cupola furnaces covered with "Gothic" tracery designs could be fed. A spark catcher is installed in the roof. The choice of Gothic forms also for the individual components is indicative of Mummenthey's desire to design an aesthetically homogeneous, self-contained building.

At the northern end of the intermediate wing, at the transition to the moulding shop, a cast iron bridge with a quatrefoil balustrade spanned the three naves; it provided access to the attic of the moulding shop. Unfortunately, nothing has been preserved of this bridge entrance. On the sectional view on the left, the inner system of the intermediate wing can be seen: interpenetrating pointed arches made of iron above the supports of the nave carry the decorative and decorated zones of the upper loft. The intermediate wing is covered with narrow, strip-like pointed barrel vaults formed by the joining of the ribs of the vault and the iron roof "beams" which have higher starting points. Double pitch roofs cover the aisles which barely enable light to be admitted through the upper loft area (7).

The drawings on plan No. 15 are concerned with the window openings in the apses. Triple-light tracery windows were built which were covered by pointed arches. An oculus with an upright quatrefoil was inscribed in the spandrel of the arch. The middle section of the tracery terminates in a quatrefoil cut in half. The lateral sections of the tracery break up in the centre and allow the centre to end in a tracery design very much like the leaf of a lily. The tracery was made of cast iron; the initial drawings and design drafts, some of them more sophisticated in design, have been preserved (8).

From these plans, all of which were drawn by Mummenthey, the foundry hall of Königshütte, which has meanwhile been rebuilt completely, can be clearly reconstructed. That these drawings are by no means mere drafts or project drawings, but have actually been executed, can be proved by engravings and historic photographs (9).
First of all, the question arises who was the architect-engineer who designed and built this foundry hall in 1828-1832. Who was the man, and what was his background? Karl Heinrich Mummenthey was born at St. Andreasberg on May 12, 1799 as a son of the mining carpenter Heinrich Christian Mummenthey and his wife Juliane Charlotte. He spent his youth in the Harz Mountains, learned the carpenter's trade, initially tried in vain to be accepted at the mining academy and was finally employed by the Clausthal building yard which was responsible for the maintenance of all mining and ironworks facilities in the Harz region. Mummenthey does not seem to have travelled abroad for his training; he remained in the Harz area for his whole life. After his apprenticeship he became a supervisor of the construction of the foundry of the St. Andreasberg silver works in 1822. His superiors at Clausthal, especially Machine Inspector Mühlenpfordt, seem to have recognized Mummenthey's talent rather early, for he was commended and received monetary awards quite frequently. From Mühlenpfordt, who taught projection drawing and civil engineering at the Mining Academy, Mummenthey probably learned the basic concepts of architecture.

On December 7, 1831 Mühlenpfordt, in a report to the Clausthal Mining Authorities, outlined that he proposed to hire Mummenthey as building supervisor for Königshütte "to execute building designs and supervise building construction and machines". He indicated that the new building of Königshütte "would soon be completed as a masterpiece" and that Mummenthey "in addition to the activity referred to above ... had been responsible for many other activities performed on behalf of the Mining Office and the administration of the ironworks". He had carried out this work "carefully and to the satisfaction of his superiors... so that the administration could be nothing but pleased at having such an employee".
Mummenthey remained in the Harz area for the rest of his life, up to his retirement on April 20, 1867; he died of a stroke on April 10, 1872. Mummenthey is probably characterized best as an immensely conscientious civil servant who fully devoted his activities to the administration of the mines and smelters of the Kingdom of Hanover(10).

The question remains what reasons caused Mummenthey and the Hanover Mining Administration to design the foundry hall like "a Gothic church", for other "royal" ironworks, such as Bavarian Königshütte near Waldsassen (11) begun in 1808 or Prussian Königshütte in Upper Silesia (12) built in 1798, were also erected as representative structures, but in rather "conventional" contemporary styles. Sayner Hütte at Bendorf, which was under the administration of the Prussian Mines Inspectorate, shows comparable architectural characteristics in its use of Gothic and Doric style elements and iron as a building material; one feature particularly closely related is the arrangement of the wings of the building at the sides of the blast furnace (13).
The name "Königshütte" (Royal Ironworks) is relatively easily explained. In the light of the attempts at economic and political independence of the Kingdom of Hanover important ironworks are built for the Kingdom to equip the country with material for its protection. The word "royal" must be taken as a program, a designation of rank and as a guarantee for the quality of production. That the ironworks were actually regarded as royal property and that the king acted as a patron is evidenced by a poem dated September 21, 1839 dedicated to King Ernst August by the staff members of Königshütte on the occasion of a visit of "their beloved ruler". It reads:

"Wohl mühevoll ist unser Leben und schwer der tägliche Beruf,
doch schöner Lohn wird ernstem Streben, wenn es Gediegenes erschuf,
Wenn aus der schöpferischen Hand ein herrliches Gebild entstand,
Wenn wohl gelungen, aufgegangen, der Saamen,den die Form empfangen.
Allein die Schönste aller Kronen, mit denen wohl den dreuen Fleiß,
Die heil'gen Himmelsmächte lohnen, wird heute unser höchster Preiß:
Der König ziehet bei uns ein, will Gast in SEINER Hütte seyn,
Will unsre Werke freundlich schauen und prüfen,was wir emsig bauen!"
(14)
To explain the "recreation" of a "Gothic" building in the 19th century, also in the light of German national history, we can also make use of the research work of Georg Germann (15). The spirit of the period "around 1800" seems to be characterized very aptly by the treatises of Goethe ("Von deutscher Baukunst" (16) or Ludwig Tieck ("Franz Sternbalds Wanderungen" (17) or Peter von Cornelius, who regarded Gothic architecture as a style adequate to "German nationality" (18). The enthusiasm for continuing continuing construction of the Gothic cathedral of Cologne had seized large parts of the population since 1814 (19). The importance of Cologne Cathedral was seen by comtemporaries, including Schinkel, in its character of a religious, historic and live monument, a sort of national monument (20). This is indicative of a fundamental concept encompassing such terms as

"religion", "fatherland" and "art". These three terms provide the proper understanding of architecture also when it comes to explaining the style used for Königshütte: "Gothic" as a style is tantamount to "venerable", "beautiful" and, for this reason, "German". After the Wars of Liberation only the Gothic style was deemed to be appropriate for architecture to be used for "Germans". In addition to the political aspect there is the religious component, which regards Gothic churches as architectural problems adequate to Greek temples, the main building problems of Antiquity, which from times immemorial had attracted the special attention of architects.
The Hanoverian "Kunstmeister" Mummenthey was familiar with these ideas through the Mining Office and Machine Inspector Mühlenpfordt. He had been trained by the latter, and the two had become close friends. Mummenthey's further building activities proved that, as an architect, he was fully conscious of the state of the art of his period. His contribution to the factory buildings of the state-owned Rothehütte near Elbingerode am Harz completed in 1827 (now located in the German Democratic Republic) is documented; the Mining Administration erected a representative blast furnace facility in the classical Doric style; especially the Doric portico was often shown on engravings (21). Mummenthey's contribution to the ironworks buildings of Zorge is mere conjecture, but also those buildings show repeated portico motifs. Anyway, it is undisputed that Mummenthey was closely involved in the architectural concepts of his period, because there is no other explanation for the style in which the iron magazine of Königshütte was built.
This iron magazine is located right opposite the "Gothic" blast furnace building and was built of timber in the traditional style.In front of the oblong storage building and the entrance Mummenthey erected a Doric portico whose corner columns, iron columns cast with concrete, Doric capitals, triglyph and metope beams, regula and triangular gable required detailed studies of Greek architecture.It is most significant, and also important for our subject, to see that iron was used for the round supports; even the flutes were engraved in the bodies of the columns. The corner pillars of the portico,however, were iron clad only in their bottom sections, while otherwise wooden boards concealed the cement core. A palmette frieze made of iron, originally bronzed, serves as the upper termination. The use of iron and, in this case, of ornamental casting was extended even further in this building, for Mummenthey inserted iron medallions decorated with leaves in the centres of the metope fields and set up cast iron monuments of apostles and saints in front of the triglyphs; unfortunately, the figures disappeared in the last war. Mummenthey's attempt to apply all his architectural knowledge in building Königshütte is evident from the fact that his closure structure of the courtyard was a magazine of unadorned, classicistic-modern forms with a ground floor made of stone and an upper floor made of timber; opposite it there was the old administration building, which was still part of the older ironworks built as the traditional timber structure found in the region of the Upper Harz. In this way Mummenthey linked old buildings with new ones and, almost like a programme, confronted his "German" Gothic blast furnace facility with the Antique,Doric, Classicistic architecture of the iron magazine. However, a fact not to be overlooked is the eminent position of Königshütte within the Hanoverian state economy. Yet, it would be wrong to regard the Gothic and Antique buildings merely as empty, vain decorations serving representative purposes. Religious and patriotic components surely play a major role in the underlying concepts. On the other hand, Mummenthey most certainly knew Sayner Hütte from reports, writings or drawings, because the mining districts in Germany always kept close

contacts: new technologies, new exemplary buildings and other improvements in mining always were quick to spread to mining and ironworks authorities. In addition, to this day there have always been very close personal connections between leading miners.
Karl Heinrich Mummenthey, a "Kunstmeister" and sworn mining official employed by the Kingdom of Hanover, built ironworks whose design can be compared only to the foundry hall of Sayner Hütte, which is only three years older than Königshütte. Mummenthey was 28 when he began the building; at the age of 31 he had already completed his chief work. However, it must not be overlooked that also the construction of Königshütte was part of an overall architectural rebuilding programme of the Clausthal Mining Administration, in the course of which also Rothehütte was modified and rebuilt (22).

The question remains which parts of Königshütte were built of iron and glass and what reasons may have caused the choice of those materials. In the foundry hall, first of all, the building between the blast furnace and the moulding shop must be mentioned. Undoubtedly, function played a decisive role in selecting iron as a material: temperatures in front of the tap hole are high, there will be sparking etc., which could cause other materials to catch fire. For these reasons, it was obvious to build an iron structure. However, it is remarkable that, unlike the Sayn installations, Mummenthey did not use Doric, but Gothic forms for such building components as the column supports with their bases and capitals, which added to the historic and stylistic homogeneity of the building. On the other hand, in this way Mummenthey did not adhere to the current architectural theory that Tuscan-Doric elements are better suited for load carrying purposes than Gothic elements. This idea was followed in early structures of the pumping systems of Nymphenburg Palace built 1807-1808, which are splendid examples of early machine building and ornamental iron casting. For our purpose it may suffice to say that the pumps of Johannisbrunnenhaus, which were designed by Josef von Baader (1763-1835), have structures for the pumping beams comprising twelve cast iron pillars, six on each side, which accomodate corniced iron girders (23). Even if the Munich installation is only a relatively small pumping station, it should not be overlooked that the machines, especially the structure, could well have been made of stone,whereas iron was preferred as a material although, undoubtedly, it was more expensive and more difficult to produce in this aesthetic form. On the other hand, constructing the pumping facility with a structure of stone would certainly have taken much more space. The use of iron as the material is indicative of the basic idea that machine facilities were built in accordance with the materials employed, that is to say, iron: In 1768 John Smeaton built the first cylindrical blower of iron for the Carron Ironworks in Scotland, in this way introducing cast iron as the dominating material of machine building (24).

As early as in 1777, Abraham Darby III of Coalbrookdale, England had begun to cast the first parts of the cast iron bridge over the River Severn designed by Thomas Gregory. The bridge, which consists of prefabricated components, was dedicated in 1779 (25). The first cast iron bridge to be built on the European continent was erected over the Striegauer Wasser near Laasan in 1796 (26). This development, in which cast prefabricated components were suddenly used for architectural purposes, is due to the improved production capability of cast iron. For the first time one was able to cast larger quantities, and more capable, more efficient smelting and processing techniques indicated possibilities never considered before, These new techniques took a long time to become accepted. However, in the first quarter of the 19th century, all of a sudden, a large number of new, very capable

ironworks and foundries sprang up in Germany. The same period is characterized by a tremendous increase in the output of mines and ironworks, at least compared with previous periods, which naturally is connected with, and due to, the use of better and more efficient machines. The fascination iron as a material must have exerted over people in the late 18th and early 19th centuries is largely due to the fundamental impression made by such machines as steam conveyors, pumps, blowers, railways and locomotives. These machines were shrouded in a myth of Cyclopean forces tapped which, sometimes, were not trusted entirely (27). Perhaps it is due to this secret feeling of insecurity that the form of a Gothic church was used for Sayner Hütte and Königshütte. Gothic designs were known, one felt safe and sure in them. On the other hand, an identification had been prepared of capability, i.e., modern machines, with new materials, i.e., iron, and the logical conclusion was that one had to think about the functional character of materials. Those were the questions Friedrich Weinbrenner covered in his "Architektonisches Lehrbuch" in 1819 (28). It may well be assumed, therefore, that ironworks such as Sayner Hütte or Königshütte were built and regarded as machine-like production facilities and conveyance systems in the early 19th century for which the choice of materials to be used could be made on the basis of the same selection criteria as in mechanical engineering.
One illustrative example is Antonshütte built in the Erzgebirge Mountains between 1828 and 1832, which was designed wholly in the Gothic forms of a three-aisle building. In the buildings erected in the Gothic Revival style a cylindrical blower was installed, the so-called Schwarzenberg blower designed and cast in 1830 by Friedrich Brendel (1776-1861). This blower, which was more than 5 m high, rested on Corinthian columns interconnected and reinforced by tracery bridges which corresponded to the Gothic tracery components of Sayner Hütte. Again, prefabricated parts were used. The congruence of Gothic architecture with Gothic interior decoration is evident; also Antonshütte must be regarded as a building paralleling Sayner Hütte.

The phenomenon of standardized prefabricated components is also found in the window traceries of Lauterberg Königshütte, which were made of cast iron. Since the production of that facility had always included excellent ornamental castings, the fabrication of such sections and traceries was no problem for moulders and casters (29). The portico of the iron magazine is illustrative inasmuch as it indicates those components which were made of iron in an architectural style otherwise preferring timber. Obviously, very elementary impressions of load carrying and load distribution led to the supporting members being made of iron and, as in the case of Königshütte, even being filled with cement and concrete, respectively, in order to further add to the strength of the material. The ornamental metope-tryglyph frieze was made in a desire to enhance the representative character of a building by adding aesthetic elements of ornamental casting.

In summary one can say that the use of iron in the foundry hall of Königshütte is largely for functional reasons, that iron as a material experienced a tremendous upswing, almost a discovery as a building material, in the first quarter of the 19th century, and that new impetus was given to machine building, which was also reflected in architecture. The possibility to produce large numbers of iron components by improved blast furnace technologies much more quickly, cheaply and in larger numbers than before led to new creative possibilities for engineer-architects also in architectural problems which previously had not been open to the use of iron as a building material: the construction of the iron spire of Riddarholmskyrkan of Stockholm built in 1835 bears witness to this fact. That engineer-

architects in those creations always succeeded in finding aesthetic forms for mechanical functions without leaving any outward indications of constraints is fascinating for our generation and should make us think.

Notes

1. For the history of Königshütte and the buildings preceding it, see Hans-Heinrich Hillegeist, Die Königshütte in Bad Lauterberg (Harz). Ihre Entstehung und Entwicklung bis zur Übernahme in Privathand (1871), Studienarbeit für Gewerbelehrer PH Hannover, 1963, printed as a manuscript. By the same author: Das historische Eisenhüttenwesen im Westharz und Solling. Ein Beitrag zur Wirtschaftsgeschichte dieses Raumes, Clausthal-Zellerfeld 1974. - Rainer Slotta, Der Neubau der Königshütte in Bad Lauterberg. Ein Werk des Kunstmeisters und Berggeschworenen Karl Heinrich Mummenthey. In: Der Anschnitt 28, 1976, pp. 64-80.
2. See Hillegeist (1963), pp. 43.
3. See Edmund von Berg, Lauterberg am Harz und seine Umgebungen, Clausthal 1841, pp. 44.
4. See Helmut Westerhausen, Geschichte des fiskalischen Eisenwerkes Königshütte bei Lauterberg. Lecture manuscript.
5. By chance the Deutsches Bergbau-Museum of Bochum learned of these plans. Thanks to the kind offices of Mr. Karl-Adolf Mummenthey of Moers I was able to examine his family archive. Inspection of the sources revealed a total of 23 plans and drawings, some of them of large size, 15 of which relate to the blast furnace facility. - Ad plan 1: Mummenthey'sches Familienarchiv, Moers: 33.9 x 20.9 cm; no designation, undated, unsigned; black drawing ink on yellow paper, no watermark.
6. ibid.: 47.9 x 37.1 cm; designated "Neubau der Königshütte betreffend" and "Ein Theil der vorderen Fronte des Hohofens;" dated "Clausthal, March 09, 1828"; signed Mummenthey; black drawing ink on yellow paper; water mark: lily, underneath VG; scale: "20 Fuß C.M." (=Calenbergisches Maß); subsequent calculations in the upper left hand corner.
7. ibid.: 51.4 x 34.9 cm; designated "Neue Hohofen- und Frischfeuer-Anlage zur Königshütte. Scize zum Schwischenbau zwischen dem Formgebäude und Hohofen", and "Profil nach d.L.A.B.", "Gebläse", "Hohofen", "Cupol-Öfen," "Dammgrube", "Därrofen", "Grundriß des Formhauses", "Profil nach der Linie C D", "Giebel-Fronte", "Aufrisz nach der Linie N M"; undated, unsigned; black drawing ink on yellow paper, some additions made in pencil. The drying oven is coloured red and yellow, in the bottom right hand part the gallery leading to the attic is entirely drawn in pencil; watermark: ATMAN; scale "90 Fuß Calenb.Maass".
8. ibid.: 52.9 x 41.5 cm; designated "Fenster für Königshütte", "Profil nach C D", "Profil nach A B", "Grundriß eines Fensterstabes in natürlicher Größe"; undated, unsigned; black drawing ink on yellow paper; watermark: J.W.; scale "4 Fuß Calenb. Maass."
9. Hillegeist (1963), p.48, mentions Machine Director Mühlenpfordt as the builder of Königshütte. Surely he will have examined the blueprints in his capacity of teacher and promoter of the architect, and also in his function as Machine Director of the Administration and will have cleared the plans. However, the plans bearing Mummenthey's signature, the architecture really built and Mummenthey's vita admit of no doubt that he not only designed but also built Königshütte.

10. The basis of Mummenthey's vita is the personal record (Acta Personalia C.H.Mummenthey 1799-1872) in the archive of the Mummenthey family, No. 135, and the family records compiled by Emil Mummenthey, Director of Bernburg potash works, which are also part of the family archive.
11. For Königshütte, cf. Rainer Slotta, Technische Denkmäler in der Bundesrepublik Deutschland I, Bochum 1975, pp.205 (= publication No. 7 of Deutsches Bergbau-Museum).
12. For Königshütte, cf. Wilhelm Salewski, Alte Eisenwerke in Schlesien und Mähren. Industrieansichten aus der Sammlung Albrecht Haselbach in München, Holzminden 1962, Tables IX - XII and pp.85. In the construction of Königshütte some architectural elements were built in the Gothic Revival style, but the overall impression is that of a very massive, rigid Baroque-Classicistic style.
13. Sayner Hütte was built by the Preußischer Revisionsbaurat Carl Ludwig Althans in 1824-1830, which makes it only three years older than Königshütte. Cf. Friedrich August Alexander Eversmann, Die Eisen- und Stahlerzeugung auf Wasserwerken zwischen Lahn und Lippe und in den vorliegenden französischen Departements, Dortmund 1805, pp. 93. - Josef Röder, Bilder und Pläne zur Geschichte der Sayner Hütte und der Sayner Giesshalle.Teil 1, in Jahrbuch der Stadt Bendorf am Rhein, 1974, pp.60 and Teil 2, ibid. 1975, pp. 103. - Gerhard Seib, Die Giesshalle der Sayner Hütte. In: Der Anschnitt 26, 1974, issue 5/6, pp. 38-45.
14. The poem is kept in the archive of Königshütte. My gratitude goes to Messrs. Karl-Heinz and Helmut Westerhausen for their willingness to let me examine the records in the archives. For the conditions described here, see also Johann Friedrich Ludwig Hausmann, Über den gegenwärtigen Zustand und die Wichtigkeit des hannoverschen Harzes, Göttingen 1832, p. 213: "The new Königshütte is a truly Royal Plant which can certainly compete with Rothenhütte as far as beauty is concerned. The latter is built in the so-called Gothic style which offers many advantages in use of the rooms and adequate lighting. In the new Königshütte it is both the taste displayed in individual parts of the building and especially the cast iron ornaments, which indicate the capability of the foundry of that plant, and the excellent handling and working of the limestone blocks from the older seam formation used for that building".
15. Georg Germann, Neugotik. Geschichte ihrer Architekturtheorie, Stuttgart 1974.
16. Quoted from Ernst Beutler, Von deutscher Baukunst. Goethes Hymnus auf Erwin von Steinbach, seine Entstehung und Wirkung, Munich 1943, p. 18.
17. Ludwig Tieck, Franz Sternbalds Wanderungen. In:Tieck, Werke in vier Bänden, Band 1, 1963, p. 852.
18. Quoted from Leopold David Ettlinger, Denkmal und Romantik. Bemerkungen zu Leo von Klenzes Walhalla. In: Festschrift Herbert von Einem zum 16. Februar 1965, Berlin 1965, p. 62.
19. Cf. Germann (1974), pp. 87.
20. Cf. Alfred Freiherr von Wolzogen, Karl Friedrich Schinkel. Aus Schinkels Nachlaß: Reisetagebücher, Briefe und Aphorismen, mitgeteilt und mit einem Verzeichnis sämtlicher Werke Schinkels versehen, Band 3, Berlin 1883, p. 193. Cf. also Georg Friedrich Koch, Schinkels architektonische Entwürfe im gotischen Stil 1810-1815. In: Zeitschrift für Kunstgeschichte 32, 1969,p.300.
21. Cf.Mummenthey, Moers, family archive, Acta Personalia C.H. Mummenthey 1799-1872. - Moreover, Hillegeist (1974),p.15,Fig.7.
22. Cf. Slotta (1975), pp.240.
23. For the Munich pump facilities see Rainer Slotta, Technische Denkmäler in der Bundesrepublik Deutschland, Band 2: Elektrizitäts-, Gas- und Wasserversorgung, Entsorgung, Bochum 1977, pp. 318 (= publication No. 10 of Deutsches Bergbau-Museum). Further references can be taken from that book.
24. See Gemeinfaßliche Darstellung des Eisenhüttenwesens. Issued by Verein Deutscher Eisenhüttenleute, Düsseldorf 1937, p. 12.
25. Cf. Note 24, p. 13.
26. ibid. - Reference should also be made to the wrought iron cupola on the eastern crossing tower of Mainz Cathedral (1828) or the steel structure of Karlssteg over the Vltava in Prague built by Mitis (also in 1828) and the galleries with roofs made of iron and glass.
27. Lewis Mumford, The Myth of the Machine. Culture, Technology and Power. Quoted from the German edition, Vienna 1966.
28. Friedrich Weinbrenner, Architektonisches Jahrbuch, 1819. Quoted from Die Verborgene Vernunft. Funktionale Gestaltung im 19.Jahrhundert (= Katalog der Neuen Sammlung München), Munich 1971,pp.34.
29. Cf. also Ludwig Beck, Die Geschichte des Eisens in technischer und kulturgeschichtlicher Beziehung, Band 4, Das 19. Jahrhundert von 1801 bis 1860. Braunschweig 1899, p. 310.