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Editorial

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Editorial: Patents in civil engineering and construction systems

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Innovations are key factors in civil engineering and engineering science. They can be found in all areas related to both disciplines: from technical materials and transportation and hydraulic structures to construction informatics and its associated information technologies. Within these developments in civil engineering, patents play a crucial role: on the one hand, they protect innovations, and on the other, they drive the development of further technical innovations.

To protect the market products emerging with the onset of industrialization in the 18th century from competition and to stimulate economic competition, internationally coordinated patent laws were enacted, initially in 1734 in England, in 1790 in the United States of America, and in 1877 in Germany. Pottage and Sherman describe the resulting change in *Figures of Invention: A History of Modern Patent Law* as a “disembodying of knowledge”: the original knowledge about the manufacture of an object shifts from the craftsman to the economically and legally regulated production of the invented object. The applicant obtains the exclusive right of use through a patent. This not only avoids copyright issues but also counteracts the failure to register innovations. The resulting monopoly position is not without consequences for a successful product. Licenses for the exploitation of a promising invention can be acquired for compensation. Furthermore, competitors are often encouraged to improve or reinvent it. Financial gains act as an incentive for almost relentless activity in the field of invention. The economic development of the last two centuries can therefore be partially attributed to the patent system. Due to its importance for the commercial exploitation of inventions, there is hardly an area in construction technology in which patents are not directly or indirectly effective. In other words: construction technology development is almost unthinkable without patents. This situation prompts us to turn to the topic of patents in this *ENHH*-issue.

When dealing with patents in civil engineering and engineering science, technical experience and theoretical knowledge merge. Of course, this is not about the notions of the inventive genius, as in Thomas A. Edison's reference to the origin of technical innovations in the tension between inspiration (2%) and perspiration (98%). Rather, the focus is on factual issues concerning technical inventions, the prerequisites for a patent claim, the economic significance of invention patents, the exploitation of patents, the

development of inventions, the value of inventions, counterfeit lawsuits, etc. Furthermore, attention is turned to the practical solution of technical problems. The invention is studied in general and specifically related difficulties. The inventor's attempts and failures are just as important as the steps that make the technical innovation functional. At the same time, the focus must be on the respective national and international competition. Finally, obtaining a patent is viewed by professional inventors and public limited companies as a guarantee of market success. Consequently, a distinction must be made between various individual and institutional patent strategies. Analyses of construction management, planning, and calculation of buildings of all kinds are not excluded. For the investigation, it is a decisive advantage that the patent drawing attached to the patent specification contains extensive information about the legally protected object. The patent is thus a historical and factual source.

The *ENHH*-edition presented here focuses on patents in the fields of building construction and individual building elements of the 20th century. It therefore does not examine the socioeconomic aspects of patents in civil engineering and structural engineering, which would provide insights into the structural interrelationships of our built environment. Instead, four case studies discuss patents that broadly address the fundamental problem of structural engineering development, formulated as early as 1866 in Karl Culmann's *Graphic Statics*, regarding stable structures with the greatest possible material savings.

The *ENHH* edition presented here demonstrates the use of civil engineering patents between 1930 and 1980. The topics addressed range from the repurposing of structures based on older patents and the strategic use of patents to the clarification of engineering issues and the establishment of a new type of material. Ilaria Giannetti, Fabio Di Carlo, and Valentina Florio address the development that begins while such construction systems are still in their final stages in their study of bridges constructed using *Balkenträger mit freiliegenden Stützpunkten*, patented in 1866 by Heinrich Gerber. This design with beams supported on both sides allows for unusually precise stability calculations. The team of authors examines the application of the Gerber scheme using concrete examples of reinforced concrete bridges built in Italy between 1930 and 1970. The

focus is on prefabrication and prestressing methods that allow an assessment of the construction history and monument preservation.

Rouven S. Grom examines the construction methods of an aluminum window type that was popular in the 1970s, primarily in southern Germany (Bavaria), and the related market-strategic aspects of the patent. Marketed under the name “Window Block System,” the aluminum window is characterized by an unusually narrow frame width. The high aesthetic standards it meets in this way make it a preferred construction product. The author shows how several window manufacturers hoped to gain economic advantages with the help of patents and utility models.

The patents for a steel mushroom column and a matching slab, launched in 1964 and 1967 by the Geilinger Group based in Winterthur, Switzerland, are linked to a unique structural concept. Tiago Matthes demonstrates how innovations in the column sector using shear head reinforcement are being developed into a commercially promising product. Prerequisites for success are the calculation methods and the establishment of structural standards.

Strategic aspects of the patent rightly receive special attention in Matthes’ study, as this steel mushroom column is part of the development of structural analysis systems still in use today.

Nina Irmert traces the history of aluminum’s use in Switzerland between 1930 and 1970. Using patents that legally protect aluminum structures and objects, the article outlines the economic development of the aluminum industry and the efforts of metalworkers and architects to harness the material innovatively. It is indeed possible to give aluminum a form that is appropriate to its purpose. Thanks to numerous patents related to the material, aluminum design products and building details have become well-known beyond Switzerland’s borders. The strategic role of the patent is clearly evident.

Overall, the contributions address patents for engineering calculation methods, business models, design methods, and materials engineering processes. The patent as a tool for formulating and disseminating technical innovations gains clarity with regard to its respective strategic use.