

## The adventure of the Guastavino vaults

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This paper registers among the investigative works conducted for the «Guastavino Co. 1885–1962. The Re-invention of the Vault» exhibition, inaugurated at the *Museo de América* of Madrid in October, 2001 and later presented at the *Universidad Politécnica de Valencia* and the *Colegio Oficial de Arquitectos de Barcelona*. It was organized by the *Instituto Juan de Herrera* (ETSAM), the *Centro de Estudios Históricos de Obras Públicas y Urbanismo* (CEHOPU), the *Subdirección General de Arquitectura del Ministerio de Fomento* and the Avery Architectural and Fine Arts Library of the University of Columbia, and was overseen by the author with the collaboration of scientific coordinators Santiago Huerta and Salvador Tarragó, and researchers Esther Redondo and Gema López Manzanares. The research is registered in the exhibit book-catalogue *Las bóvedas de Guastavino en América* (2001. Madrid: Instituto Juan de Herrera).

In the history of construction, several episodes characterized by the transfer of vaulted forms from Spain to America could be related.<sup>1</sup> Among these is one of special significance: that featuring Guastavino, who arrived at the port of Manhattan from Barcelona in 1881, ready to found a construction practice in the United States with roots in the Mediterranean vernacular tradition. Decades later, the system he developed—now known as the Guastavino System—had been used to erect more than one thousand important vaulted constructions in North America, several hundred of them in New York, and had characterized a good portion of the most important

buildings in the United States: from the cathedrals of the medieval revival to the huge, modern vestibules of skyscrapers . . .

This well-defined chapter in the history of construction is concerned with outlining Guastavino's true contribution to the historical experience of the timber vault; demarcating the work undertaken by Rafael Guastavino Moreno and that conducted by his son, Rafael Guastavino Expósito; questioning their professional mandate—architects, businessmen, propagandists or inventors?—; analysing the terms of the professional relationships they maintained with their American architectural collaborators; and, finally, discussing the reasons for their sudden success and, also, their subsequent disappearance.

The architectural quality of the spaces created by the Guastavinos is not elusive. Its effect could, perhaps—among the frequent *slanted* constructions of the time—be best described by the order and dignity his constructive reason granted to architecture. It is surprising, therefore, to learn in what scant measure concrete references to the Guastavinos appear in publications which dealt profusely with the constructions they erected: their name has remained overshadowed, so many times, by those of the great architects with whom they collaborated.

George R. Collins, the great and studious—shall we say—*reivindicator* of the Guastavinos showed just how strange it is that so little attention is paid to



Figure 1  
Rafael Guastavino Moreno (ca. 1880)

this singular chapter in the history of vaulted construction. Often times, it was precisely the distinction of containing a *Guastavino vault* as the principle—if not the only—spacial effect which allowed many of the buildings constructed between the 1880s and the middle of the twentieth century to be included in the most selective classifications of United States architecture (Collins 1968, 176).<sup>2</sup>

#### THE CATALAN PACING

Rafael Guastavino Moreno (1842–1908) was born in Valencia and studied at the *Escuela de Maestros de Obras* of Barcelona (1861–1866) (Bassegoda 1973, 86),<sup>3</sup> where he had such important professors as Juan Torras and Elías Rogent;<sup>4</sup> they pointed him toward the system—then still in an embryonic state—he would later develop (Guastavino 1892, 9).

In 1868, he presented as part of his design for the Batlló textile factory in Barcelona what would constitute a veritable technical revolution, and for which his name would receive temporary distinction in the world of Catalan construction. The spectacular loom room, covered by a series of spherical vaults

rested upon metallic supports, was the first great prototype of the incorporation of what Guastavino called «cohesive construction» in the configuration of a new kind of industrial architecture.

The rapid growth of industry in Catalonia in the second half of the nineteenth century required a system of construction for large manufacturing buildings that could effectively combine economic considerations and fire safety measures. Guastavino's success consisted in returning to a technique long-employed in popular Catalan architecture, that of timbered vaults,<sup>5</sup> and, through the incorporation of current materials—fundamentally portland cement in place of lime mortars—converting it into a modern system of construction and further developing it with modern perspectives.

The landmark Batlló factory prompted many businessmen to take an interest in the process, securing Guastavino other important projects; it also served to change the opinions of construction professionals with respect to the modern application of this type of vault.<sup>6</sup>

From here, Guastavino managed to extend this system of construction and formulate new proposals for large urban developments. This was the setting for the «Improving the Healthfulness of Industrial Towns» study which he presented at the Philadelphia Foundation Centennial Exposition (1876). Here, he presented the advantages of his system of construction, characterized by its resistance to fire, and applied them to the search for urban healthfulness and rapid industrial growth.<sup>7</sup> The fact that his report was favourably received in the contest, gaining distinction with a prize, awakened in Guastavino a certain intuition that this success in his first contact with the United States would lead to others. He understood that North American society, in the middle of a human and material resources boom, offered him unforeseen opportunities. What to do—even considering his life's other circumstances—<sup>8</sup> but to set off for the United States five years later at the risk of losing the prestigious professional position he had earned in Catalonia?

#### ENCOUNTERING NEW YORK

When Guastavino arrived in New York in 1881, he was met with a panorama that included two factors

which would influence his trajectory: on the one hand, an openness to the new building materials—portland cement, laminated steel, concrete—which were replacing traditional and combustible wooden structures; on the other hand, and as a counterpoint to what the Chicago School was putting out in those years, the progressive expansion of a taste for *Beaux-Arts*, whose general acceptance across the whole of the country would come about later.<sup>9</sup> Also, and of more than trivial importance, the deep mark left by the Chicago fire ten years earlier was still being felt.

Guastavino's precarious arrival in the United States did not allow him, initially, to carry out the type of work he had been doing in Spain. Yet, by 1883 he had won the competition for the Progress Club building in New York and constructed several residential buildings, in which he *programmatically* employed timbered vaults as a fire-resistant construction system.

From these same beginnings in New York, he practised an active policy of patenting fire-resistant building procedures based on bricks and vaults *a la catalana*. By 1885 he had registered the name «Construction of Fireproof Buildings» and, after a very few years, with a conglomeration of patents grouped together below the denomination «fireproof», he was able to produce materials (special brick pieces, mortars, metal reinforcers) and building procedures (large timbered vaults, forged vaults, staircases *a la catalana*, partitions . . .) which conferred an operative efficiency upon the soon-to-be-called *Guastavino System*. Guastavino's great intuition was reinvigorated by the possibilities that were opening up to him; he was following a path very distinct from that of the strict exercise of professional architecture.

#### THE GUASTAVINO FIREPROOF CONSTRUCTION COMPANY

With his first great work, the Boston Public Library (1889), he had the opportunity to put the advantages of his system of vaults to the test against other customary processes, and to lay bear—with his boldly dressed intradoses—some new and attractive formal possibilities (in other respects quite in keeping with the aesthetic trends of the moment). As a result of this project, conducted in collaboration with the

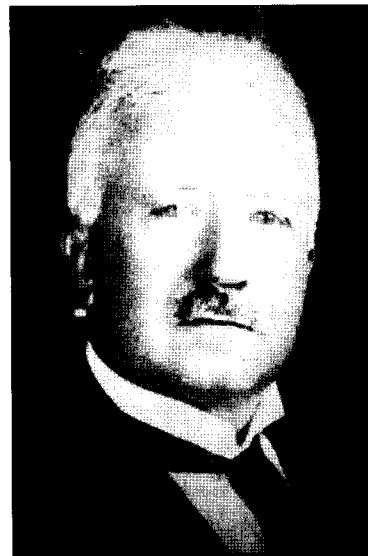


Figure 2  
Rafael Guastavino Expósito (ca. 1925)

prestigious architectural firm McKim, Mead and White, he received wide-spread resonance and publicity, decisive in defining his professional orientation.<sup>10</sup>

With the confirmed acceptance of his system of construction, and counting on the security afforded him by his registered patents, he founded the Guastavino Fireproof Construction Company in 1889. From this moment on, his work—with the option for independent architectural activity definitively rejected—is tied to the company, such that when we refer to *Guastavino vaults* we are referring to a complex production process, thoroughly developed at the time, which long-outlived its founder: after his death it would be his son—Rafael Guastavino Expósito (1873–1950)—who would take charge of the business, which would not go into liquidation until the year 1962.<sup>11</sup> After the firm's liquidation, professor Collins acquired the vast Guastavino Company archive for the University of Columbia, where they are currently held.

The skill with which Guastavino founded his business is evidenced by the fact that, only ten years after his arrival in the United States, he had opened offices in several cities—New York, Boston and



Figure 3  
Fire-resistance test with a timber vault (New York, 1897).  
(Guastavino is the second from the left)

Chicago— and had amassed a large number of important constructions.<sup>12</sup> What resources granted Guastavino such an early and resonant success, having started from nothing? One consideration which, in large part, answers this question is the progressive control that the company was establishing in all phases of the construction process: designs and patents, testing, fabrication and manufacture of distinct types of brick, distribution and execution. This control brought with it a high amount of quality control, an active collaboration with project architects, an increase in working speed and a decrease in the price of construction.

The work undertaken by the Guastavino Co. over seventy years, far from being restricted to the chores of labour contracting and patent control, must be judged as essentially *architectural*, definitive in the spacial and formal lineage of buildings. The conformation of the architectural space that necessarily accompanies the vaulted system makes it impossible, in many cases, to treat form separately from construction; this lends particular interest to the study of the relationship between the company and the teams of architects with which they collaborated (Parks 1999, 23).

The Guastavino system offered a copious fountain of formal and spacial resources, it made possible a creative relationship —receptive to experimentation and the search for different technical and expressive possibilities— with the personality of each architect. If with firms like McKim, Mead and White<sup>13</sup> he

would explore, during many years of collaboration, extremely dissimilar spacial and structural organizations, with project authors such as Henry Hornbostel he would achieve maximum levels of innovation in the development and articulation of superficies,<sup>14</sup> and with teams such as Cram, Goodhue and Ferguson, particularly interested in the conditions of vault linings, he would demonstrate the modelling and acoustic abilities of the different materials the system offered.

If the architectural aesthetic which reigned in New York upon Guastavino's arrival favoured the success of his vaulted forms, linked in greater or lesser measure to previous languages, it is not less certain that the Guastavino system was able to abide by the new formal tendencies and, in many cases —embracing very dissimilar architectural types— it propitiated a modern language expressively inspired by constructive sincerity. Guastavino's work features, in any case, a discourse on construction: it is not at all strange that —



Figure 4  
Pennsylvania Station, New York, 1905–1909. (Demolished in 1963). (With McKim, Mead & White)

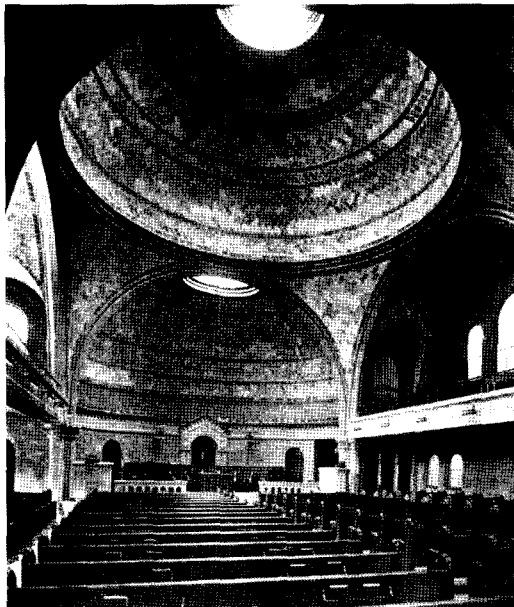


Figure 5  
Amity Baptist Church. New York, 1907–1908. (With  
Rossiter & Wright)

as he affirms in his *Prolegomenos* (Guastavino 1896)—he held the deterministic constructive logic of his strict contemporary, Choisy, in such high esteem.

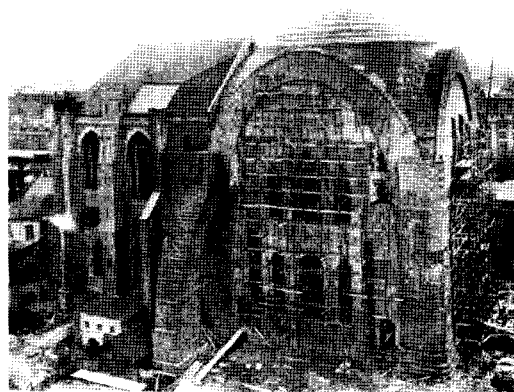


Figure 6  
Construction of the Cathedral of St. John the Divine, New  
York, 1892–1932. (With Heins & LaFarge, Cram &  
Ferguson)

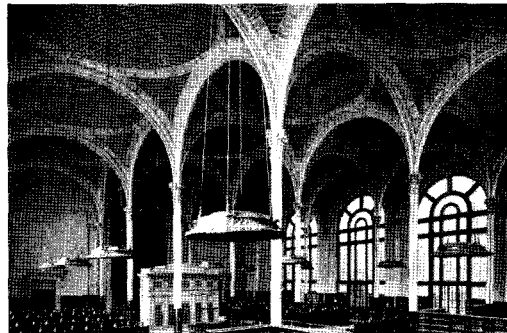


Figure 7  
New York State Education Building library. Albany, NY,  
1908.1911. (With Palmer & Hornbostel)

#### UTOPIA AND CONSTRUCTION

As a counterpoint to the efficient diffusion of publicity with which the company always took great care, there is another aspect which stands out: the rigorous scientific and technical diffusion, by way of publications and reports to congresses, that Rafael Guastavino's system became. Even during his Catalan period, the treatises of modern timber vaults was decidedly non-existent; this motivated him, after his first successes in the United States, to publish several studies which led to the publication of his *Essay on the Theory and History of Cohesive Construction* (1892).<sup>15</sup>

This work, the most complete compendium of his ideas about construction, is a living defence of the



Figure 8  
Vaults at the Oyster Bar, Grand Central Station, New York,  
1911–1913. (With Reed & Stern, Warren & Wetmore)

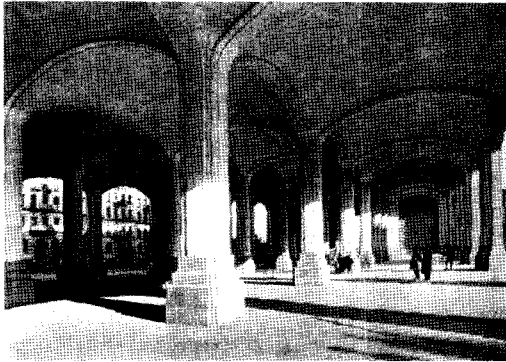


Figure 9  
Queensborough bridge, New York, 1917. (With Palmer & Hornbostel)

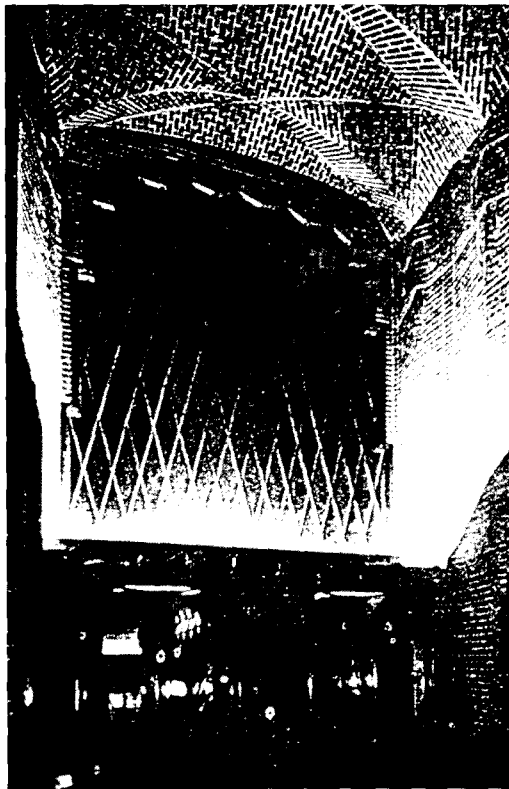


Figure 10  
Lobby at the Western Union Building skyscraper, New York, 1929. (With Vorhees, Gmelin & Walker)

timber vault system, in which he takes great effort to show its advantages over concrete construction (which he himself had explored in its beginnings) (Guastavino 1892, 14) and over traditional voussoir vaults. In this book —and in later publications— he also touches on what we could call a *philosophical* defence of the role that masonry has played in the history of construction. In contrast to the traditional gravitational system of vaulting, whose mechanism relies on the voussoir form (it would be possible, from a conceptual point of view, to join them without any adhesive), he presents the *cohesive* or *organic* system, in which the adhesive capacity of the mortar makes possible new and more economic processes, with a notable reduction, if not the elimination, of scaffolding systems. He understood, and defended, this system as being specially suited to the construction of his time; he affirmed, not without a certain utopian vision, that —with the progress of new mortars and their capacity for rapid setting—



Figure 11  
Advertising poster for the Guastavino Company, with several of the most relevant vaults built

cohesive brick masonry would be the material of the future (Guastavino 1904, 30).

Guastavino, whose name remains inextricably tied to the practice of timber vaults, advanced a new chapter in the long history of the construction of light or free-standing vaults. His constructive instinct discovered a way of understanding vaulted spaces, never-before seen in the United States; his *invention* would advance far beyond what had been known in Spain and —as a reflux— would arrive back here also, in the autocratic years following the Civil War, with remarkable consequences.

Rafael Guastavino surprises us, as do his almost utopian theories, with the prodigiously regal production of his admirable ceramic vaults, an eloquent illustration of his conviction.

#### NOTES

1. The first was the encounter between both cultures itself: Pre-Columbian America was not familiar with this type of construction—a true *invention*—based on arches and vaults; . . . but soon the New World erected remarkable domes which would have —on their return trip— a profound influence in Spanish architecture. By the middle of the twentieth century, the ingenious constructor, Madrid architect Félix Candela, would fill Mexico with elegant, slender and surprising membrane-vaults, true «reinforced concrete trickery».
2. George Rosenborough Collins (1917–1993), professor of Art History and Archeology at the University of Columbia, was a studious enthusiast of Spanish architecture. His interest stems from his discovery of Arturo Soria; later he focussed on Catalan architects from the late 19<sup>th</sup> century, particularly on Gaudí, whose fame spread internationally during the 1970s, and he created the most important existing archive of modernist Catalan architecture (donated to the Art Institute of Chicago); his work led him to discover timber vaults, and from here to follow the work of the Guastavinos in the United States.
3. The schools of *Maestros de Obras* were shut down in 1869 (the new School of Architecture of Barcelona didn't begin to grant titles until 1875); the collective of the *Maestros de Obras* had, until that moment, an important role in Barcelona.
4. Rogent would come to be the first director of the School of Architecture of Barcelona.
5. Light vaults made with brick placed sideways, generally in several layers, that can be made with light or even without scaffolding systems.
6. This process had come about by combining empirical experience and constructive instinct: little to none of the process or its methods of calculation had been systematized.
7. Guastavino released this paper when North American public opinion —still impressed by the fire that had nearly flattened the city of Chicago in 1871— showed a special sensitivity to security conditions in cities which, after the War of Succession, had been experiencing enormous growth.
8. He left for the United States —with his nine year old son Rafael— after his marital breakdown.
9. The Universal Columbian Exposition of Chicago (1893), in which Guastavino participated, was the event that did away with the advanced formal lines that had been deposited in the city over the years.
10. The technical publications of the time described their surprise at this process that permitted the raising of vaults without using scaffolding. Following the success of this work, in 1889 Guastavino was invited to give several conferences at the Massachusetts Institute of Technology's Society of Arts (these would later be collected in his *Essay* . . . ).
11. In 1943, Guastavino the younger sold his stocks, leaving A.M. Bartlett as president. William E. Blodgett and, later, his son Malcolm, were decisive figures in the constitution and rapid development of the company: they directed the financial aspects of the business, and knew how to deal with the deep periods of economic depression that were appearing around the country: the Blodgetts were two fundamental pillars for the Guastavino Company, whose history remains thus described by the succession of two generations of surnames.  
The company's decadence would run parallel to the increase in the cost of labor and to the perfection and development of reinforced concrete technique, which allowed for already competitive vaults to be designed with thin membranes.
12. Even though the Guastavino Company's work reached nearly all the states in the country, it was principally centered around the East Coast.
13. With this celebrated firm, the Guastavino Company made, in addition to the aforementioned Boston Library, nearly forty buildings over thirty years; among them: the University of Virginia en Charlottesville complex (around 1897) and the U.S. Army War College of Washington (1905); as well as many of the most important vaulted constructions in New York, such as the now disappeared Pennsylvania Railroad Station (1909) and the unusual syntax of glass ceramic vaults in the Municipal Building (1917).
14. Good examples are the Williamsburg and Queensborough bridges in New York (1903 and 1909)

and the *labroustian* library in the Albany State Education Building (1911).

15. This publication would be followed by others. In 1893, upon the occasion of the Congress of Architects at the Universal Exposition of Chicago, he presented «The Cohesive Construction. Its Past, its Present; its Future?», then published in *American Architect and Building News*. Later, in 1904, upon the occasion of the International Congress of Architects of Madrid, he presented «The Function of Masonry in Modern Architectural Structures».

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