# Drawings of the Guastavino Company: innovatión and promotion.

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John Ochsendorf, in his book, *Guastavino Vaulting*, says that the patents of this valencian builder, settled in the United States during the last decades of the XIX century, are not original contributions. Although some builders may have been using such a system in Spain at the time, "Guastavino appears to have been the first to treat it as a modern, standardized system, using new materials and rigorously detailing the construction methods" (Ochsendorf 2010, 155).

The father and son devoted significant time to develop technical and technological innovations. They achieved an advantageous position in the market due to their exclusivity in the construction of vaults in the late nineteenth century. And they achieved a great prestige among the leading architects, belonging to the American Renaissance, in the early twentieth century. The timbrel vault, first seemed to be just a light constructive solution, economic, and fire resistant. Then it became a hallmark, appreciated for its aesthetic qualities and its image of consistency and durability.

There is a large bibliography about the achievements of Guastavino's Company, that analyzes them in constructive, structural and even commercial terms. However it is important not to forget that many of the buildings, in which Guastavino's vaults were included, have been characterized by the configuration of the space that they provide (Collins 2001). It is a combination of efficient construction, structural challenge and a spectacular image.

Drawings of calculation, layout and detail of these vaults show clearly their rules of construction and include graphics that explain the performance of its structure. They try to show an image of transparency and honesty in construction. Both, drawings of patents and promotional posters fulfill that task, conveying sincerity. The commercial skills of Rafael Guastavino Jr. complement his father's manner of working, implementing structural and acoustic improvements, without losing his technical rigor.

The aim of this paper is to study several drawings published by the Guastavino Company, analyzing them from the graphic and architectural point of view. For this we turn to the sources of the original publications. We will study the graphic context, so we can understand the visual impact that the images sought to produce, both to potential customers as well as the general public.

Rafael Guastavino. Patent drawings. Timbrel vaults

The Guastavinos, father and son, put their best in the development and application of technology in building of the timbrel vault. To achieve their goal, they do not agree just to improve in the field of construction, but they also devoted great efforts to the development of numerous documents for the spread, published in several media, where graphic components were essential.

These documents lead to three main areas: advertisement, industrial development, and scientific documentation. The advertisement posters, were widely disseminated, either through journals in the architecture and construction field, or through editions by the company itself. The collections included photographs and drawings of their greater accomplishments. Some of the projects, as we shall see, were redesigned and transformed into generic models in order to facilitate the inclusion of Guastavino's details on the projects of others architectcs.

With a mainly industrial purpose, highlights their registration of patents, of which they came to carry out twenty-four of them in the United States, between 1895 and 1939 (Redondo 2000). These documents began only as an efficient way of raising the visibility and consistency for the building system in cuestion, but soon they become one of the keys for the Company's success. Rafael Guastavino senior achived to have exclusivity in construction of timbrel vaults nationwide. The drawings in the patents offer an interesting sequence of the evolution of Guastavino's way of work, both from technological innovations that were implemented, as well as the thinking of their authors. The correlation between the two processes figures out a great will of coherence on the contributions of the company to the American building industry.

Also very important were the Guastavino's scientific writings. Publications and lessons that came to complement the Guastavino's working site, providing the necessary scientific support to the design and calculation of its ambitious vaults. In fact there was a gap in the treatises about building on timbrel vaults and it was necessary to undertake such a task in accordance with the theories at that time (Huerta 2001). The cultural component in the late nineteenth century in the United States became an engine for social change. Through his contribution to knowledge and culture Mr. Guastavino became a respected member of the society of his time (Loren 2009)

The hypothesis of this paper is that such documents, particularly their drawings, are connected by a common intent. It could be said that many of them aim both: technical and commercial objective, with the same efficiency and at the same time. Business, artistic and vitalistic impulse go toghether in Guastavino's enterprises. And that combination is showed in each step they make to succeed in their technically audacious and professionally ambitious works.

*The first drawings published*

Rafael Guastavino Moreno arrived to the United States in March 1881. His first contacts with the American graphic diffusion media were through illustrations for the magazine The Decorator and the Furnisher. For this he would make, during those early years, different designs. They range from the representation of complete spaces, as seen in the image of a lavishly decorated bedroom (Figure 01) to the design of furniture in different styles. Between them highlights a set of seats (Figure 02) that the author suggests according to occupy spaces.

It is evident that Guastavino's ability to propose solutions that fit the tastes of the time. His first commissions as an architect evoke shapes that recall historical precedents, exotic memories, attractive for his contemporanean American burgeoning society. He was able to illustrate their projects, full of details, in Moorish, Byzantine, Greek styles, etc. Showing great consciousness in construction and decoration.

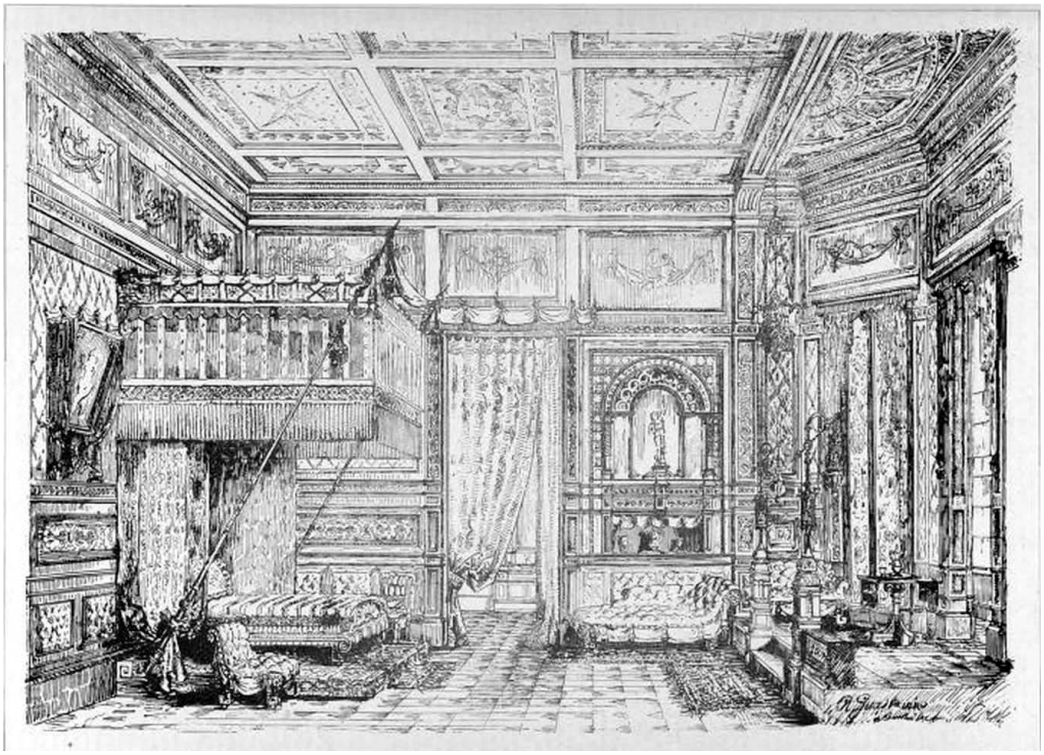

Fig. 1. Rafael Guastavino Moreno, 1884: *Design for Furnishing and Decorating of Bedroom*. Fuente: The Decorator and the Furnisher, volume 5, October 1884.

Therefore the growing of fashion styles associated to the Beaux-Arts movement of the late nineteenth century in America was a great opportunity for Rafael Sr. In 1893 the World Exposition in Chicago was a boost for the American architects trained in the french *École* (Ochsendorf 2010). Guastavino participated in the fair as the designer of the Spanish Pavilion, a Neo-Gothic work, clearly inspired by a valencian ancient building called *La Lonja.*

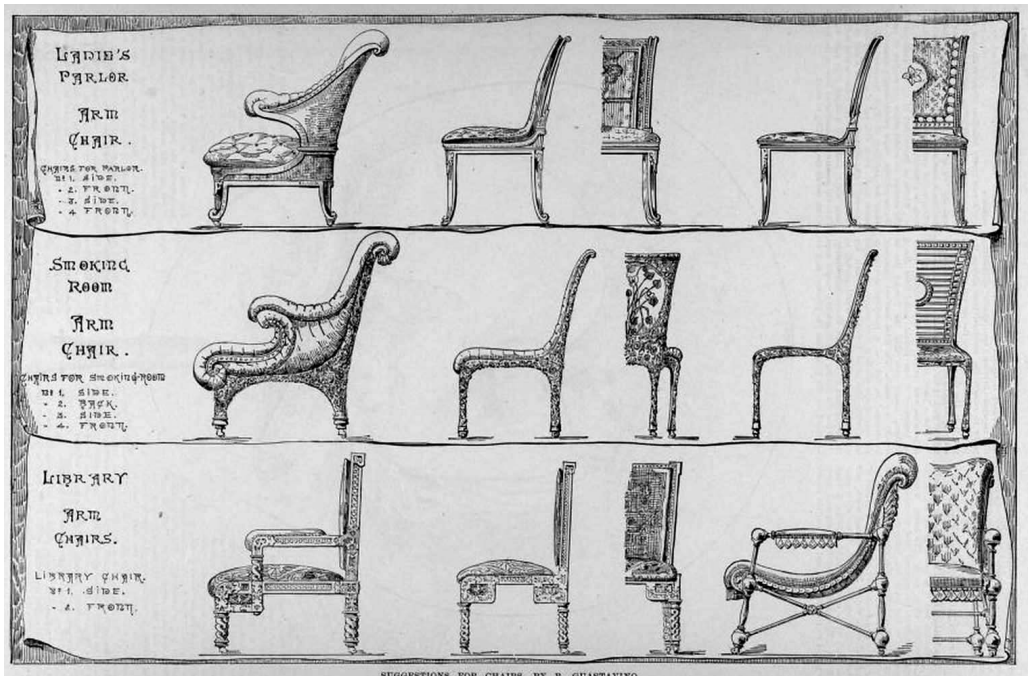


Fig. 2. Rafael Guastavino Moreno, 1885: *Suggestions for Chairs*. Fuente: The Decorator and the Furnisher, volume 6,p. 53, May 1885.

About history of construction

As a builder Guastavino senior had a strong background in traditional ceramic construction. He acquired it as a disciple from Juan Torras Guardiola as well as through his own experience in Barcelona. Among his works of this stage, highlights the dome of Centro La Massa in Vilassar de Dalt (Bassegoda 2001).

The recovery of classic styles involved the use of the vault in all its versions. This was an opportunity to get positions in the construction market. The alternative offered by Guastavino, as a builder of vaults, was to value the structures of brick, cheaper than masonry. Although first he found difficulties because of the shortage of ceramic materials and skilled labor, soon his experience and tenacity led him to success in several key works and then his product started to be very appealing to the US construction industry.

The timbrel vaults can be raised without formwork. The bricks can be built almost "in the air". Just a few planks and ropes are enough for a geometric control. The thickness of the vault is another of their striking features. Compared with arches maid of stones or reinforced concrete, emerging material at the time, this kind of vaulting has something mysterious and surprising, an innovational challenge to gravity (Collins 2001).

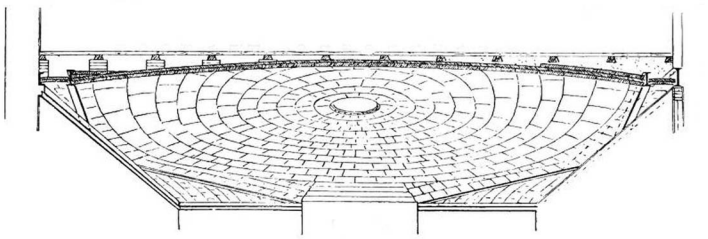

Fig. 3. Rafael Guastavino Moreno, 1893: *Essay on the Theory and history of cohesive construction applied especially to the timbrel vault*, 128. Ticknor, Boston.

The Company was able to value such assets. Their contribution could be just some well done constructions inside a group of buildings. But the Valencian builder boosted his chance looking towards the progresses of his time and incorporating them into his technic, the timbrel vault. "The Guastavino's achievement was to use a vernacular procedure, widely used in popular architecture in Catalonia, which are the timbrel vaults, to transform it into a modern construction system, by incorporating new materials, mainly portland cement, instead of mortars of lime, " (García-Gutiérrez Mosteiro 2000).

The International Congress of Architects was held at the time of the Columbian Exposition in Chicago, in 1893. Then Guastavino sr. presented a paper called The cohesive construction, its past, its present, its future. There he reproduced fragments of his Essay on the Theory and history of cohesive construction (Figure 3). The Spanish architect Mariano Belmar, present at the conference, spread the Rafael's American achievements, upon his arrival in Spain. Years later Luis Moya, in his treatise *Vóvedas tabicadas*, included a note of admiration for such work (García-Gutiérrez Mosteiro 2001).

*Patent drawings*

The concern about the devastating fires that occurred in the late nineteenth century, was remarkable in America. Interesting proposals for fireproof building systems came from Europe. Hyatt patents, were registered in England in 1877. Hennebique system, first established in Belgium and France in 1879 (Gulli 2006). Guastavino's reaction was immediate. He registered his first creations, at the eighties, not as masonry construction, but as Construction of fire proof buildings (Figure 4). They show structural elements such as stair structures and vaults to solve all kind of spaces.

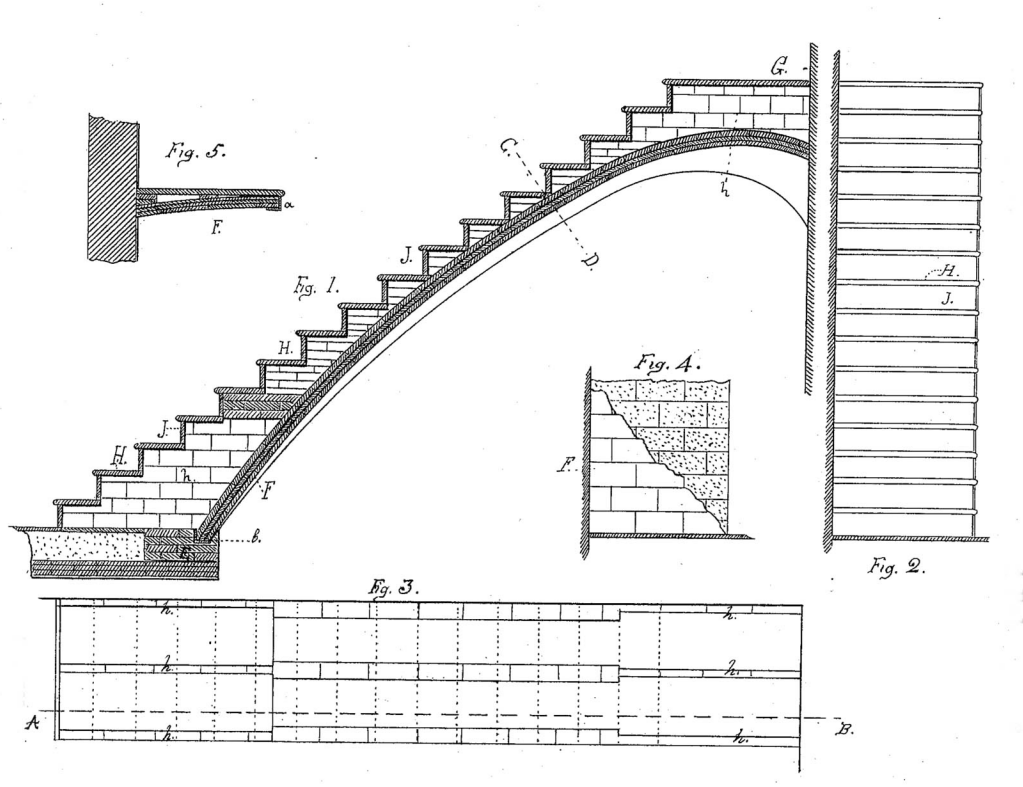


Fig. 4. Rafael Guastavino Moreno, 1886. *Fire Proof Building*, 01. Fuente: US Patent Nº 336047, February, 1886.

Guastavino was a man of his time, keen to profit the improvements available. He was aware of the latest technical developments and adapted them quickly to his business project. The fire protection was the first idea on which he put to work. Another great challenge was the structural progress. The widespread incorporation of steel on buildings soon led Rafael to deepen its relationship with brick.

The use of steel in Guastavino's Company evolved quickly. He implemented tie-rods into the brickwork. Is evident the importance of their meaning in the text by the author “I use tie-rods of iron, the material best adapted for resisting tension strain”. It is not possible to say he was using what we call now "prestressing" but his drawings are a surprising approach, in a starting way, to the huge potential this technique would have in the future. Some of the patents incorporated steel rods, within the ceramic itself, working in tension against the horizontal forces. Guastavino understand that the form can be controlled by tensions imposed from the outside of the structural element. One of the main references in the US about prestressing is Jackson's patent called "Improvements in girders" (US Patent Nº 126396), dated 1872. Far from comparing this patent with Guastavino's, signed in 1886, is interesting to underline that both of them have an conceptual similarity (Figure 5), and they appear in a very short space of time.

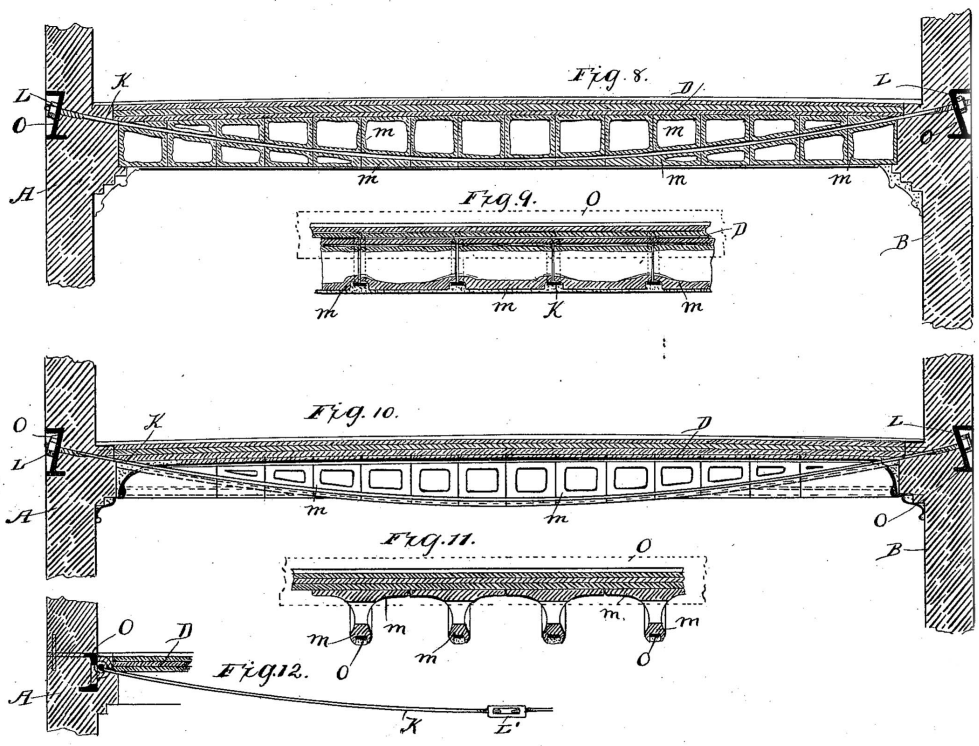


Fig. 5. Rafael Guastavino Moreno, 1886. *Construction of Fire Proof Buildings*, 02. Fuente: US Patent Nº 336048, February, 1886.

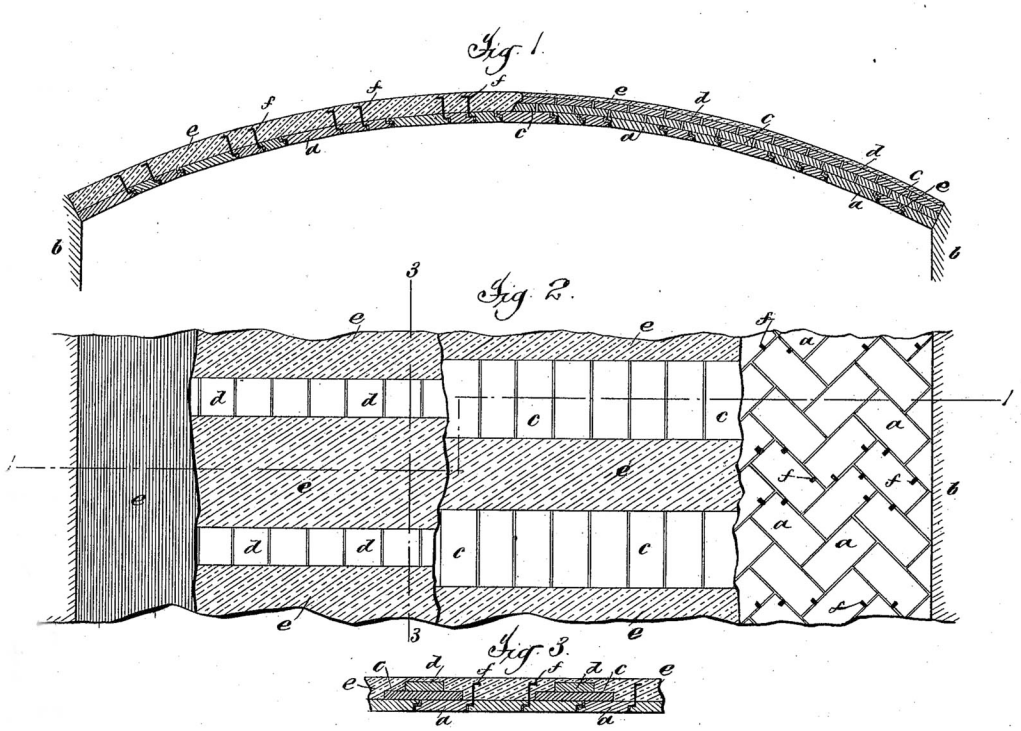


Fig. 6. Rafael Guastavino Expósito, 1892. *Construction of Fire Proof Buildings*, 01. Fuente: US Patent Nº 468871, February, 1892.

The next step comes almost naturally and steel becomes integrated gradually into brickwork as fine bars (Figure 6). Because the Company had incorporated since start Portland cement, as the basis of his system, steel corrosion is controlled properly, because of that positive combination. Again intuition becomes technique and can be considered as an great achievement of what now is known as reinforced brickwork. Deepening in the same line, Guastavino junior registered in 1910 Masonry Structure. This project included steel wires into brickwork in several directions (Figure 7) trying to provide a complete response to all types of elements in construction, such as domes, walls and floors.

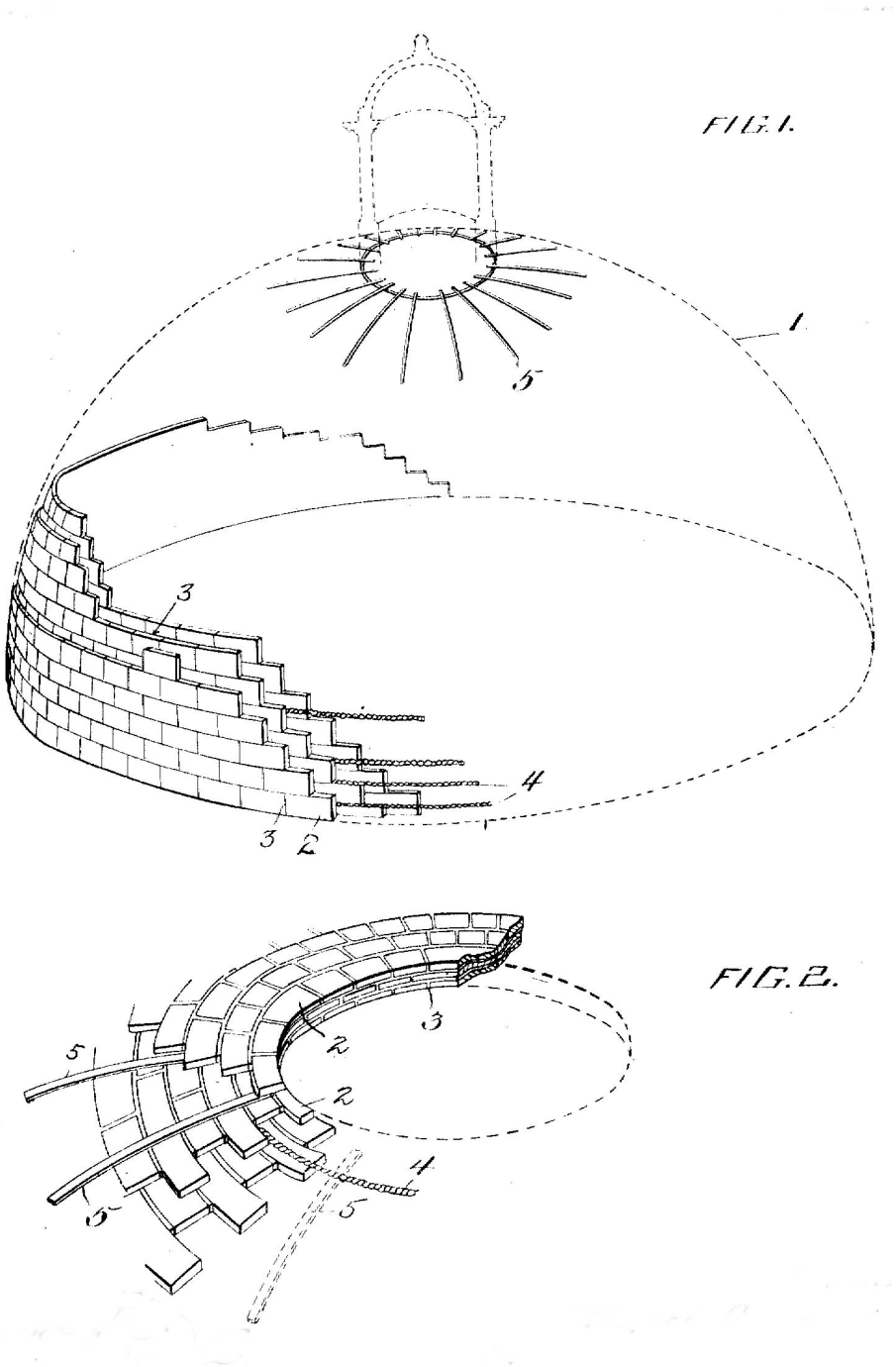


Fig. 7. Rafael Guastavino Expósito, 1910. *Masonry Structure*, 01. Fuente: US Patent Nº 947177, January, 1910.

Guastavino junior's drawings did not have the formal audacity of father's projects, but they showed a remarkable ability to improve the technology that made possible to undertake greater challenges. Longer spans, proper systems, more precise and accurate specifications for materials, were implemented by Guastavino's son. The aim followed throughout his career was to convince customers that the ceramic solutions have several advantages, such as fire protection, structural and formal consistency and all of them at a very competitive price for that time. His achievements included improvements in the absorbency of ceramics. These acoustic features were some of the most important technological advances of the system.

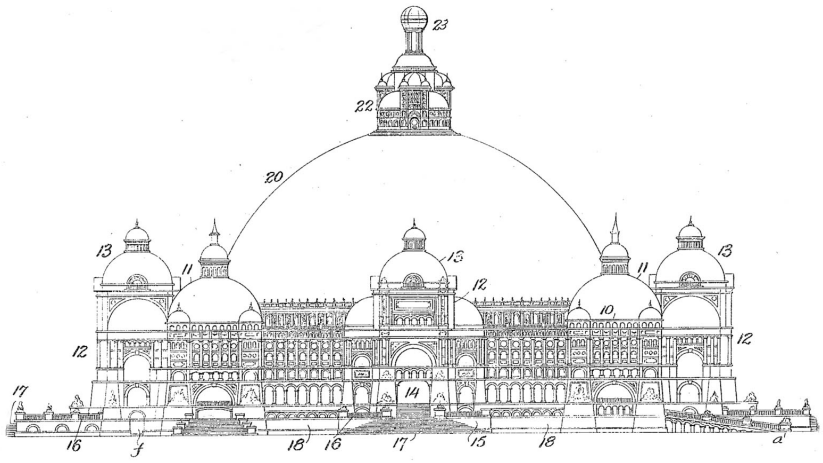

Fig. 8. Rafael Guastavino Moreno, 1908. *Structure of Masonry and Steel*, 01. Fuente: US Patent Nº 915026, March, 1909 (a título póstumo).

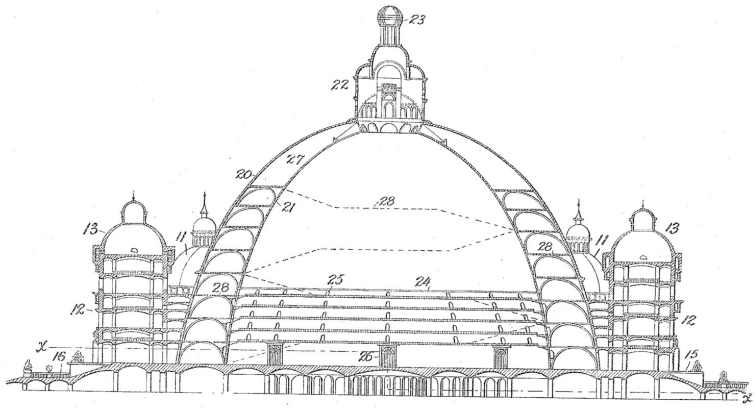

Fig. 9. Rafael Guastavino Moreno, 1908. *Structure of Masonry and Steel*, 02. Fuente: US Patent Nº 915026, March, 1909 (a título póstumo).

The posthumous patent of Guastavino senior, dated 1909, was called Structure of masonry and steel, (Figures 8 and 9) and intends to serve as a model to build all kinds of social reference buildings: museums, libraries, shopping malls, etc. Large equipment that would have a major space covered with a monumental dome. Rafael ends his career, proposing the shape of the building as a real justification of his own system. Even adapting uses and types to the geometric layout of dome. Regarding, in a certain way, Durand's lessons in the french academy, one hundred years before. Thus, he is closing a round trip from the progressive improvement of a traditional system, transforming this into something different, through a personal touch, and finally proposing a complete, perfect, closed system.

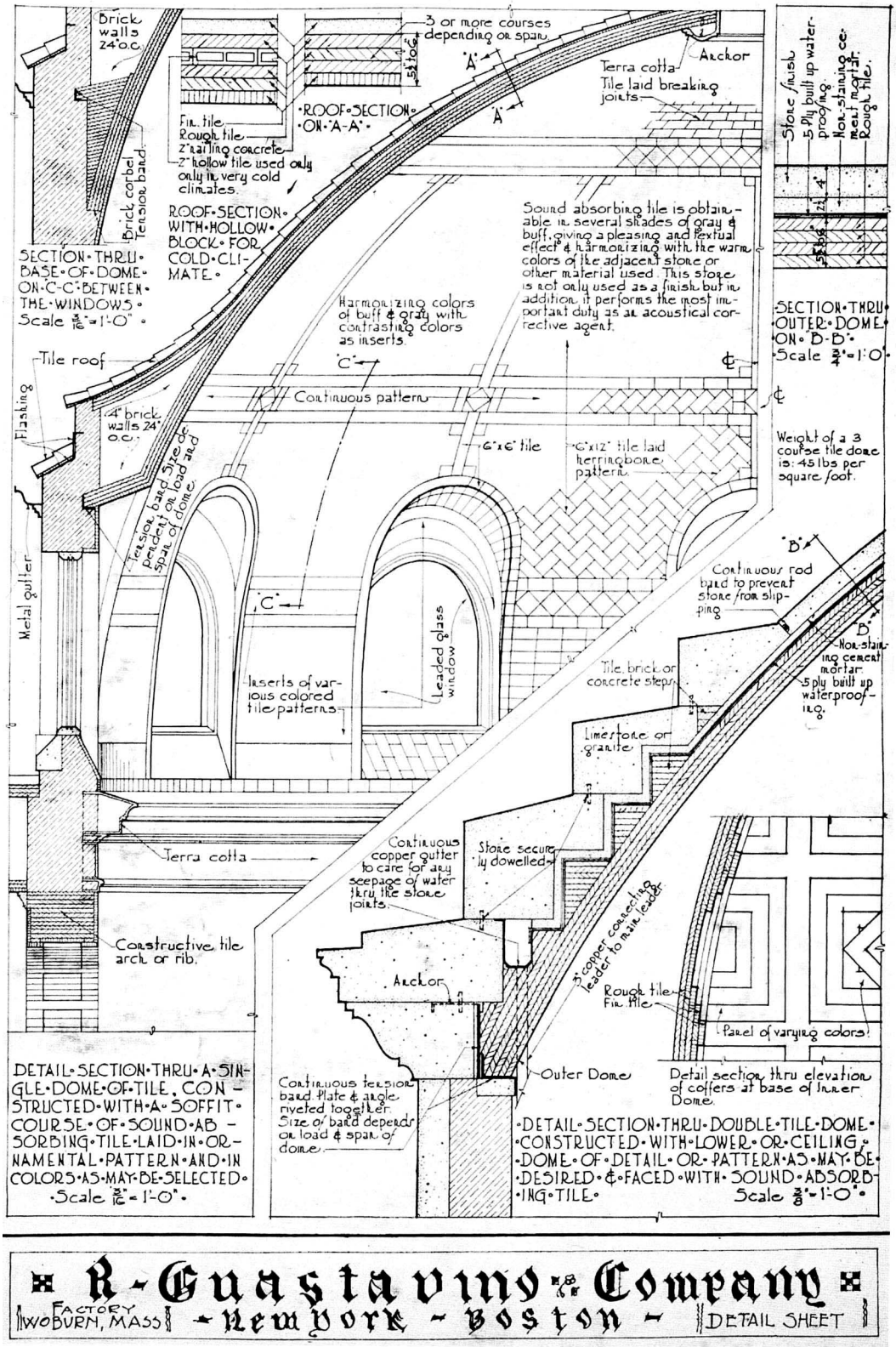


Fig. 10. Rafael Guastavino Expósito, circa 1930. *Esquema detallado de una cúpula tabicada genérica de Guastavino*. Fuente: Sweet's Catalog, 1931.

Guastavino junior, had applied his talents to improve the system to levels of remarkable sophistication, although he was less intuitive than his father about breakthroughs in building systems. Instead his business acumen was not lower and his company was present even several decades after his father's death, in the projects of the best firms in the country. For years the Guastavino's advertisements appeared in journals, such as Sweet's cataloge. In the offices of the American architects it was a common reference the Guastavino's detail sheet (Figure 10) inspired by some of the projects carried out at that moment. Rafael junior published annually designs in order to inspire architectural projects. So some of the architects used to take directly these detail sheet, including shamelessly the Guastavino's brand in their technical specifications (Ochsendorf 2010).

*Conclusions*

Guastavino understood that they were not the styles what highlighted his work, but the reliability of the integral control of the process. He managed to impress customers, to convey his impulse, improving the system and expressing efficiently the benefits of his achievements. The timbrel vault seduces not only because it involves a lower quantity of construction materials, but because it is built in the air, defying gravity. It is his greatest contribution. Rafael does not dominate the calculation methods, but try to fit them gradually, controlling errors. He did not pursue decorative design by itself, although his vaults become a hallmark, capable of transmitting at the same time exclusivity, reliability and lightness.

The drawings we show are not pretentious, they do not intended to be anything but the description of a continued progress. This produces an interesting analogy between the Guastavino's works and the tiles that make part of them. Bricks and tiles, considered individually, are modest and limited, but putting together their small individual contributions they can transform themselves into surprisingly slim construtions, almost weightless.

Guastavino's images are very eloquent at that point. As a constructive detail, the solution is clear, sincere and open. The construction technique is shown, confident in the protection granted by the laws of intellectual property in the United States. He pursues and manages to convey corporate reliability, constructive transparency, and finally remarkable consistency in the evolution of his thinking. Drawings in this article may be used to illustrate a treatise on construction, or as a base for calculation, layout, etc. as well as advertisements. But above all they show the progress being introduced experimentally and then consolidated quickly and firmly in technical and technological improvements.

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