Architecture as construction in the beginnings of Renzo Piano. Five patents for construction systems and “pieces” of buildings (1965-69)

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ARCHITECTURE AS CONSTRUCTION IN THE BEGINNINGS OF RENZO PIANO. FIVE PATENTS FOR CONSTRUCTION SYSTEMS AND "PIECES" OF BUILDINGS (1965-1969).

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Keywords

History and construction of specific projects; History of specific builders; Development of construction tools; Building materials, their history, production and use

Abstract

Between 1965 and 1969 Renzo Piano registered five "industrial inventions" at the Patent Office in Genoa. They are a construction system for modular walls, a shelter made with inflatable elements of polyethylene, an interlocking system for precast reinforced concrete beams and piers, a machine for producing shell structures and a reinforced polyester roof shed panel. Piano, having graduated in Architecture at the Milan Polytechnic in 1964, had just begun his professional activity focusing, especially, on lightweight construction systems, by using the labor force and the workshop equipment of the construction company of his family. This paper analyzes these youth experiments - following figures like Jean Prouvé (1901-1984) Pier Luigi Nervi (1891-1979) or Richard Buckminster Fuller (1895-1983) – in which Piano developed conceptual and construction strategies that he will employ in the project and building site of the Centre Pompidou (1971-77). In particular: designing the elements of the construction, where the architecture is a sheer assembly of "pieces", conceiving nodes and joints, using prefabricated components and the figurative and conceptual dominance of the coverage over the walls.

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This paper is part of a wider research about the formative years of Renzo Piano, from 1958, when he enrolled in the Faculty of Architecture in Florence, to the worldwide recognition he achieved with Richard Rogers during the international competition for the Centre Beaubourg in Paris in 1971. These are crucial years for the young Genoese architect, spent developing experimental constructions, teaching, meeting and traveling in Europe and in the USA. On this occasion I will focus on the five "industrial inventions" that Renzo Piano registered at the Patent Office in Genoa between 1965 and 1969. They are a construction system for modular walls, a shelter made with inflatable elements of polyethylene, an interlocking system for precast reinforced concrete beams and piers, a machine for producing shell structures and a reinforced polyester roof shed panel. These patents are a small part of over sixty projects that Piano carries out in these years. However, the fact that Piano, having recently graduated, decided to patent several technological devices, along with the content of these patents, allows for some discussion about the first, formative years of his profession. The five patents are the result of constructive experimentations led by Piano in the workshops and in the construction sites of his family's construction company, utilizing its machinery and labor force. The company was founded by his father Carlo in the Thirties, and from the middle of the Sixties, was headed by his brother Ermanno, a crucial support figure for the young Piano. Several photos and drawings preserved in the Fondazione Renzo Piano outline, not so much the image of an architect, but rather that of an 'inventor', constantly in contact with the material and continually looking for innovative processes to work with, following figures like Jean Prouvé (1901-1984) Pier Luigi Nervi (1891-1979) or Richard Buckminster Fuller (1895-1983). The Genoese architect, as we shall see, immediately undertakes the search for, what will become, the pillars of his design approach. With the Centre Beaubourg, we see Piano designing the elements of the construction, where the architecture is a sheer assembly of "pieces", conceiving nodes and joints, using prefabricated components and the figurative and conceptual dominance of the coverage over the walls.

During his University years, Piano looks to the *oeuvre* of Jean Prouvé. In 1965, having just opened his office, Piano travels to Paris to receive a baptism in the profession - to follow the lessons that the French craftsman held at the *Conservatoire Nationale des Arts et Metiers*. Prouvé spent the first decade of his professional life making individual construction elements: gates and lift cages, but mainly, curtain-wall and mobile partition systems for prefabricated panels with a mechanical assembly, first achieving a patent in 1931. The device designed by Prouvé accounts to fix two C-shaped metal uprights, with internal springs at the base and at the top, to the main structure of the building. By placing the panels into the slots of the uprights, compressing the springs, they are locked in place. Piano looks to those experimentations in the first of his patents, registered on February 22, 1965, with the wording: "Method for the construction of walls with panels embedded between uprights". The prefabricated panel (3), of any type or material, provided with a perimeter frame (4) shaped as a continuous gorge (104), clasps to a steel subframe composed of two cross uprights (2) and two T-shaped crossbars, upper (10') and lower (10). The two uprights are fixed to the main structure of the building (1) with a sliding guide in such a way to permit the movement in the plane of the wall. The crossbars are hooked to the uprights through notches (11, 11') and hinges so that they lift upward when the uprights are turned away, and come back to the starting position when the uprights are brought together. In such a way, turning away the uprights, the prefabricated panel can be inserted into the metal frame, and, bringing them together, it is locked. Through the repetition of this frame of uprights and crossbars, it is possible to compose modular walls – vertical, horizontal or inclined – with two or more panels, translucent or opaque, which can be quickly replaced. Like Prouvé, Renzo Piano con-

ceives of a 'dry' construction system, in which the action of the cement or chemical binders is replaced by the refined articulation of precise mechanical parts.

The same logic of "pieces" also guides the shelter of polyethylene inflatable elements, registered on November 5, 1966. This experiment fits the euphoric expectations that characterized the Sixties: from the atomic pavilion by Victor Lundy (1960) to the "environment bubble" of François Dallegret (1965) and the "pneumatic paraboloids" by Arthur Quimby (1963), for example. Conceptually, however, Piano's logic is detached from these models. While in the aforementioned cases the designers draw a single membrane that, when inflated, defines an undivided interior space, Piano conceives of a prefabricated "piece", carefully defined in every detail, industrially produced and from which shelter is derived by its assembly. The basic module – the "piece" – is composed of a square surface on which a flexible hemispherical cup is glued. Both the base and the cup are polyethylene membranes, with thicknesses of 2-3mm and 5-10 tenths of one mm, respectively.

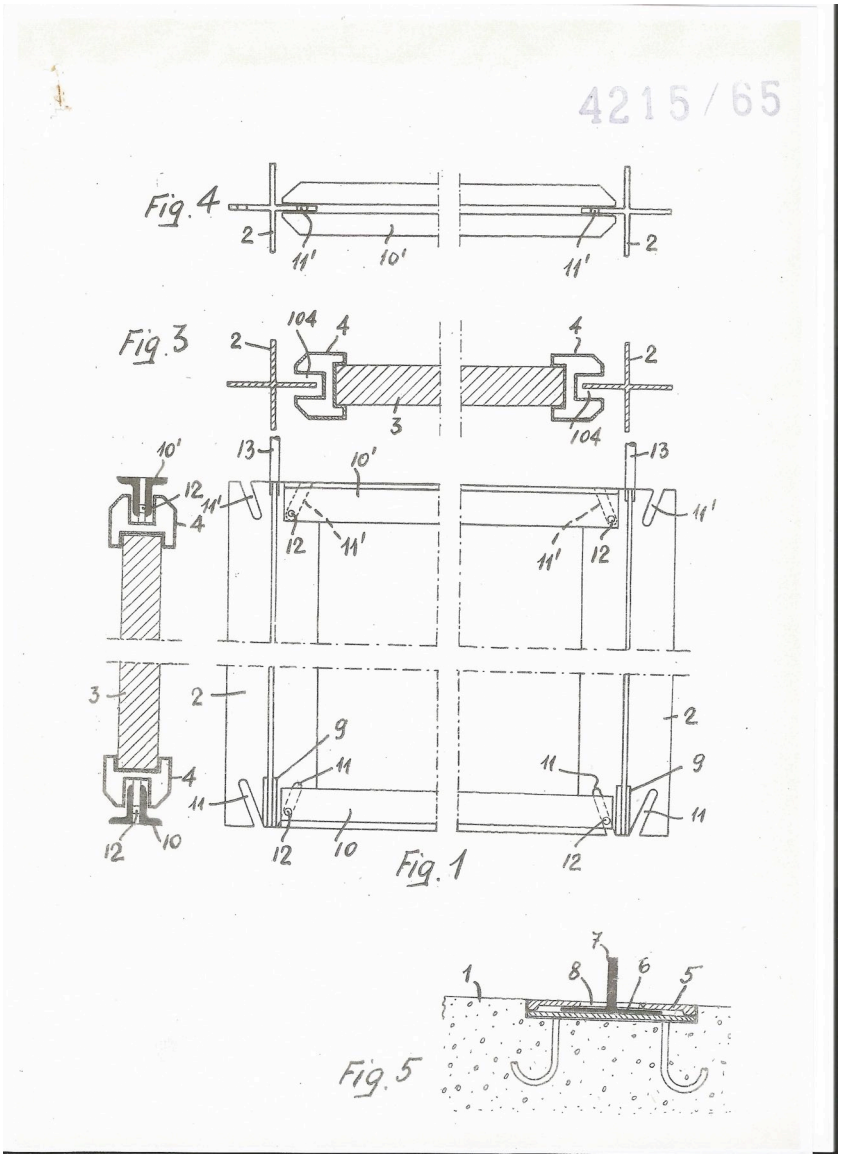

Figure 1: Drawings attached to the patent dossier "Method for the construction of walls with panel embedded between uprights".

At the top a threaded sleeve - that in the realized prototype is replaced by a simple valve from a bicycle’s tire – crosses an aluminum disk, penetrating inside the cup. At this point, the sleeves are joined to both the metal rods that connect the several inflatable elements, thus composing the shelter, and the hoses that, linked to the source of gas, ensure the inflation of the air chambers.

Figure 2: The structure in inflatable elements that Piano builds in the garden of his house in Genova Pegli in 1966.

Few days separate this patent from another, registered on November 21, 1966, concerning a ‘dry’ joint system for bearing prefabricated reinforced concrete elements. "The purpose of the invention – Piano states - is to provide a dry joint that allows a quick and easy assembly and disassembly of bearing prefabricated elements, while presenting a great resistance and ensuring maximum safety". The prefabricated elements to be joined (1, 101, 2, 102, 3) are embedded in a system of complimentary parts, protruding or recessed (20, 21, 22). In addition, the metal bars of a first element (1) are bolted to metal pieces of junction (13) consolidated with the internal metal bars (104) of the second element (101). I wish to emphasize that the mechanism certified by this patent, despite its simplicity, states the attitude toward a dry assembly of prefabricated parts that will characterize the design method of Renzo Piano and, since the Centre Beaubourg, enforce his conception of the building site as an assembly line.

The fourth patent concerns a machine for producing curved structures with plastic membranes or concrete. Registered on July 18, 1967, it attests to the keen interest of Piano in the processes rather than just the finished product. The Genoese architect, before moving to Milan Polytechnic, spent his first two years of university in Florence, where he had the opportunity to study the fig-

ure and work of Filippo Brunelleschi, a man forged in construction sites, able to, not only design the dome of Santa Maria del Fiore, but also - in the words of Piano - "to invent the tools that make possible its realization" (Piano 1986). Piano, reflecting on the importance of control and even the design of the machines that produce the elements of the building, states, "the machine that produces the building is already the building".

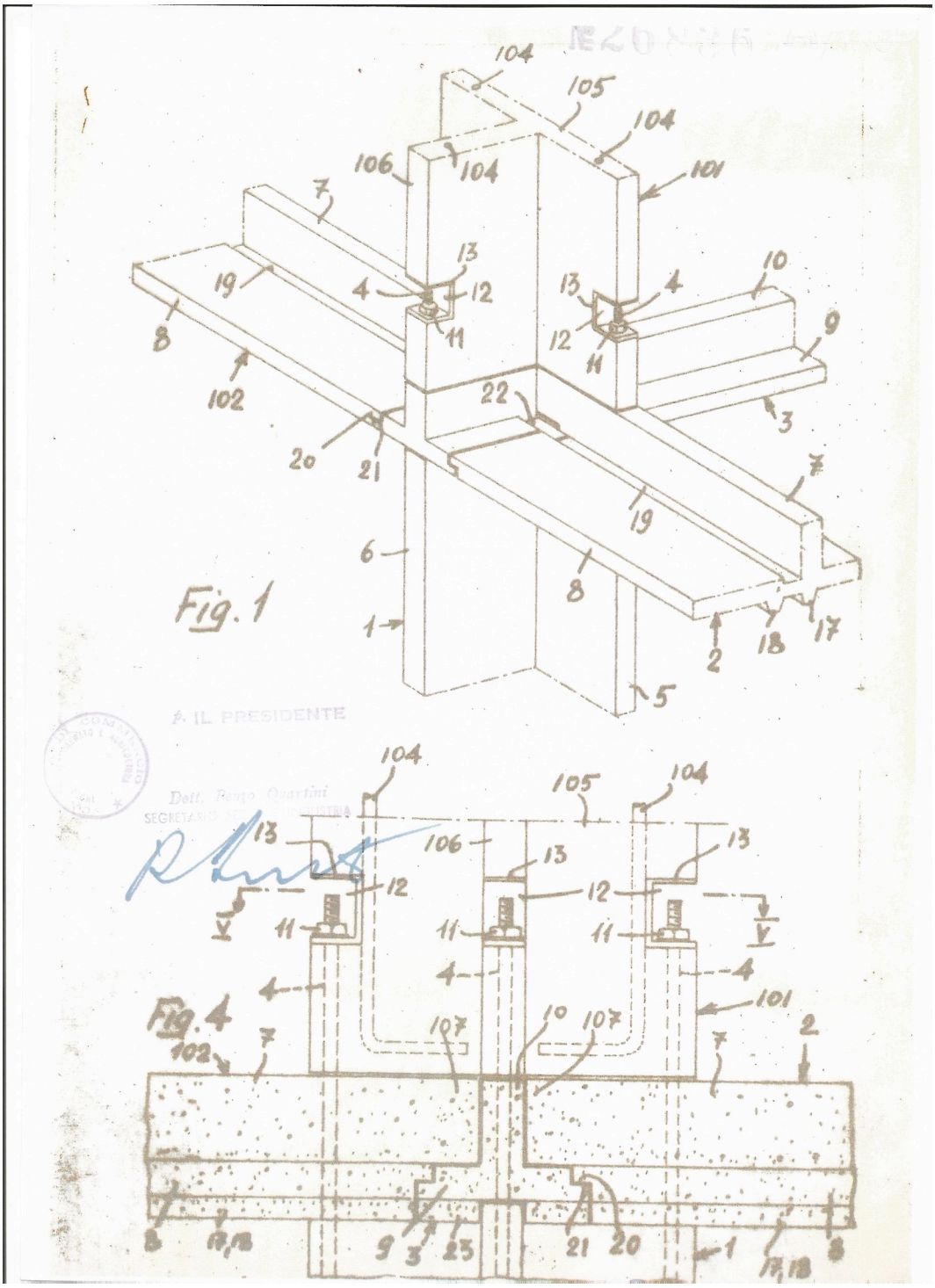

Figure 3: Drawings attached to the patent dossier “Joint system for prefabricated reinforced concrete elements”.

This patented device, in which Piano is flanked by engineer Flavio Marano, employs a detector that decrypts the coordinates of a scale model of the curved structure to be built. The model is divided into sectors - for example by drawing a grid pattern of lines. The parts of the structure will each match, on a larger scale, a sector of the model. The detector is connected to an electronic processor which controls the input and output of fluid under pressure to a mesh of plungers that deform appropriately a flexible sheet of rubber on which - for casting or coating - are formed from time to time the pieces of the structure.

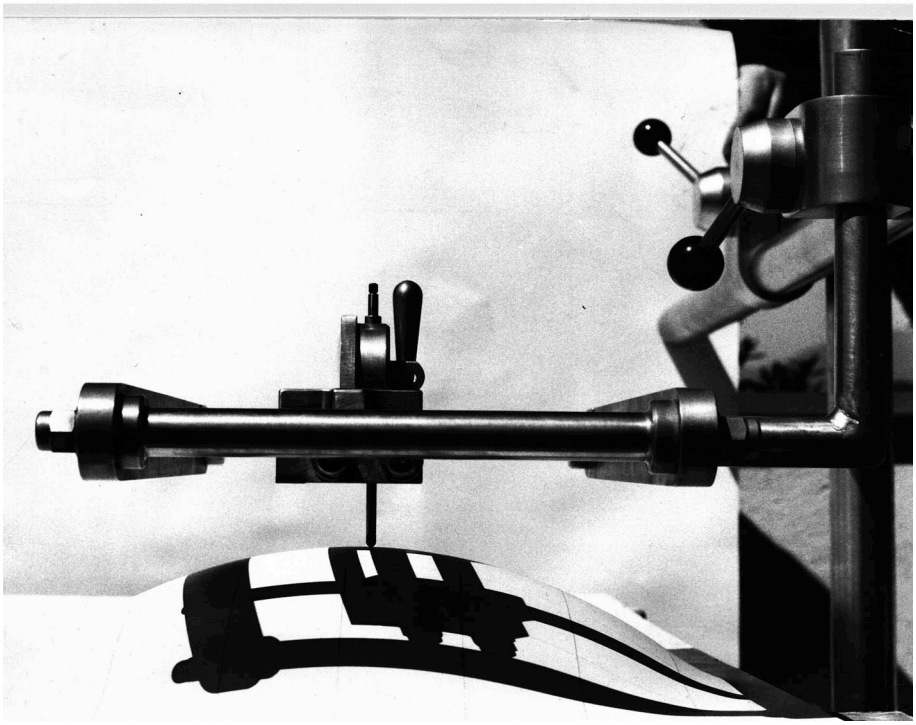

Figure 4: The detector that decrypts the spatial coordinates of the scale model of the curved structure to be build.

Figure 5: The flexible sheet of rubber on which the pieces of the structure are formed.

In the only built example, assembled in the gardens of the Palazzo dell'Arte at the 1968 Milan Triennale, the membrane of the curved structure consists of two layers of reinforced polyester interspersed with a layer of polyurethane foam. The connection of the individual parts of the structure is obtained by injecting foam into the joints between the individual precast panels. Again, the structure is not derived from the design of a shape but through the joining of individual "pieces," products in the workshop.

Figure 6: The assembly prototype in the gardens of the Palazzo dell'Arte during the 1968 Milan Triennale.

The last patent, the fifth, registered on March 7, 1969, relates to a shed roof element, prefabricated in a double slab of reinforced polyester, chemically welded, and interspersed with an inner tube. At the lower sheet, flat, is superimposed the upper one, knurled. The upper sheet, knurled, is superimposed on the lower sheet, sitting flat. The vertical translucent walls of the shed allow for the passage of light, and are opposed to those that are inclined and pigmented with a special matte paint. Piano experiments with this shed panel during the construction of the covering of his office in the Erzelli hill, near Genoa. The panels are oriented to extend the translucent walls to the north, and to shield the direct and dazzling light from the south. The search for a rarefied, dosed and constant light - "of a sheer beauty" as Banham will celebrate as it is filtered by the "leaves" of the Menil Collection (Banham, 1987) - is anticipated by the unique shape of this shed panel, also subtend the complex 'machines' that Piano will design: the "leaves" of the Menil Col-

lection (1982-86), the “flying carpet” of the Fondation Beyeler (1992-97) or the "skylights" that cover the expansion of the High Museum in Atlanta (1999-2005).

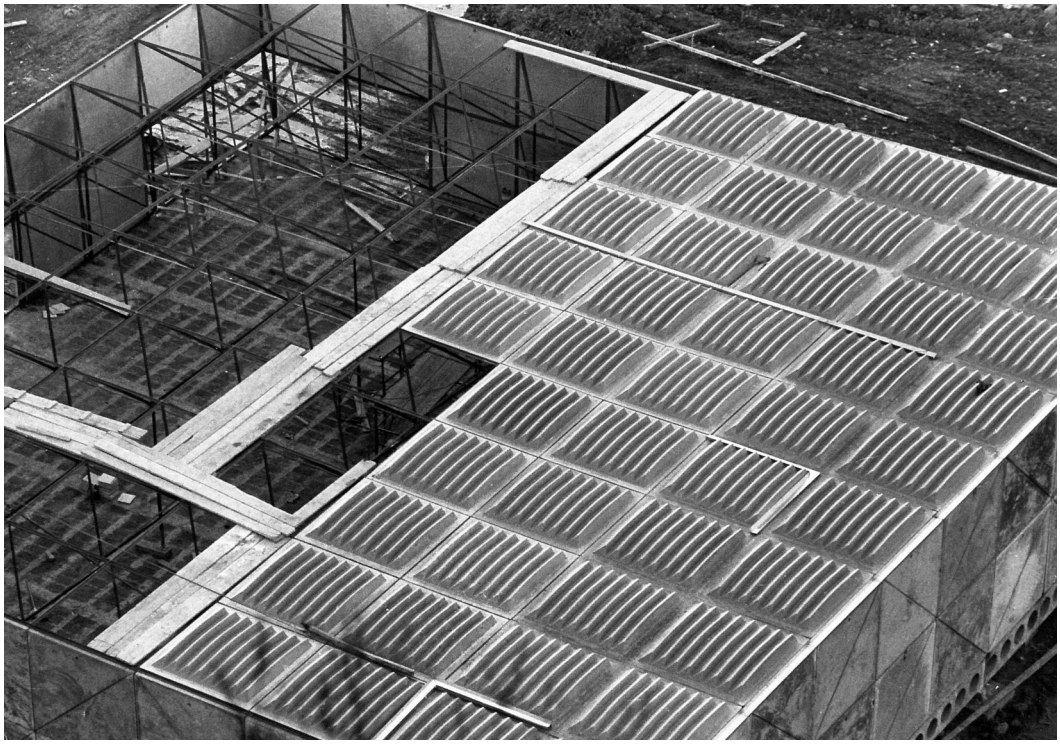

Figure 7: Building of the roof of the Piano office at the Erzelli in Genova in 1969.

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