

CONSTRUCTION

A CONSTRUCTION SYSTEM FOR LARGE BUILDINGS

ARCH.202 ARCH.241

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I. Introduction

The design of your building must involve an interplay between the conception of space and the formation of a structure which will support the space. If you familiarize yourself with the construction sequence and you follow the procedure below, this task will be made simpler.

Keep in mind the basic concepts underlying the construction system. Buildings are made up of forty foot wings with two parallel walls which run longitudinally. The main beams, spanning laterally, are supported in the walls and have at least one additional vertical support roughly in the middle of the wing. The floors and ceilings, span the major spaces and determine the location of these main beams.

Also keep in mind that the building is constructed of reinforced, poured-in-place concrete and concrete block. For structural and economic reasons, the base of the building is formed reinforced concrete. Above the base, the wall, beams, and columns are an integral structure of concrete blocks and reinforced concrete. (figure 0)

II. Design Procedure

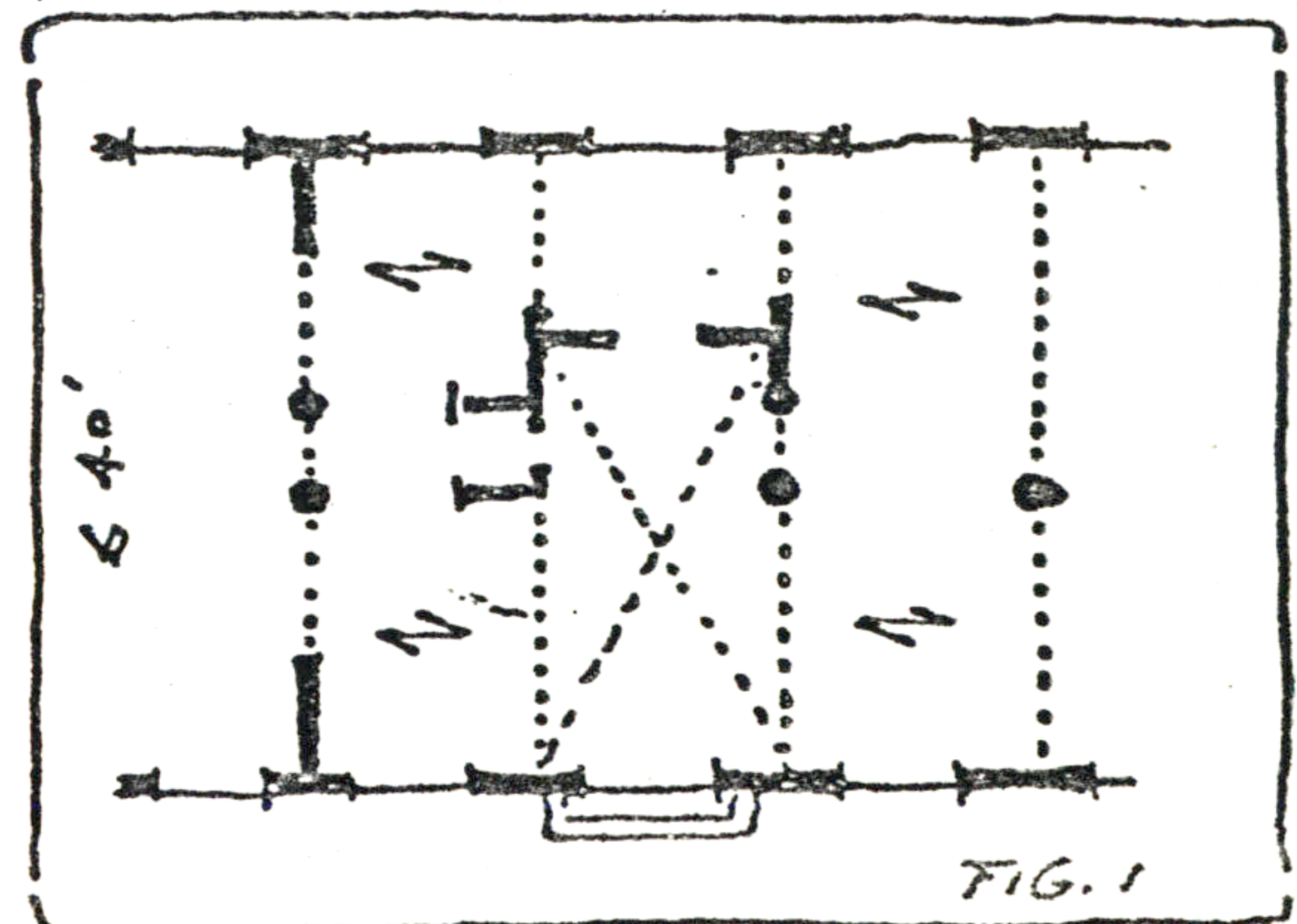
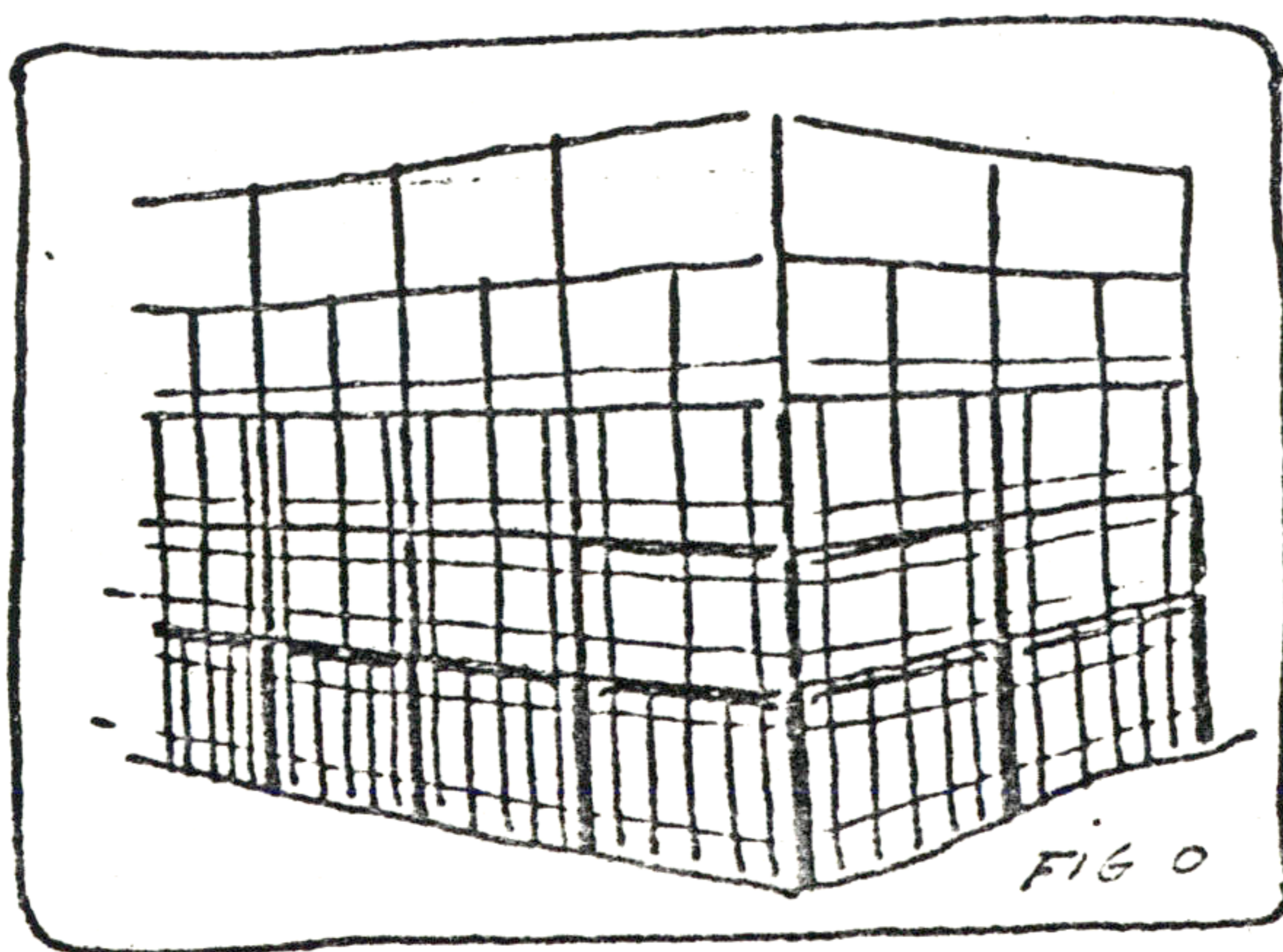
1. Determine the main spaces contained in the base of the building.
2. Position columns, structural walls, vaults, and the main beams to give the desired volume and shape to the main spaces. In no instance require beams which span more than twenty-five feet.
3. Place the rough openings in the concrete base.
4. Now, having set initially the structure of the base, form the main spaces of the upper floors, keeping in mind the need for a continuous vertical structure which rises through the building. Position columns, walls, and main beams to shape these spaces.
5. Now that you have the basic structure in mind, examine it to see that all columns and structural walls have support below. Make adjustments in the structure and in the floor plan if necessary, to assure this vertical continuity.

6. Determine the smaller spaces within the main spaces which you have already formed. Locate walls around them.
7. Form the ceilings and floors around all spaces, using ceilings to achieve the desired volume and shape. Include the design of the roof.
8. Locate all rough wall openings throughout the upper floors of the building.
9. Locate all mechanical systems.
10. Give each part of the structure, columns, walls, beams, vaults, ceilings, and floors the necessary bulk and reinforcement. Begin to "build the building" in your mind, considering the way each material is used. Begin to consider how ornament is made as the building is constructed.
11. Now give shape and substance to the wall openings, by thickening materials where they join. Design window frames and sash, door frames and doors.
12. Make a final determination of the substance of all parts of the building, in order to create the colors, textures, patterns, and shapes you desire. Determine precisely how ornament is made in the building.
13. Determine all finish work to be done during construction, e.g. interior floors, walls, and ceilings and the design of any required artificial lighting.

III. Construction Sequence

The wings of the building are constructed with two parallel walls ^{max?} forty feet apart. The main beams run between these walls, and have additional vertical support roughly in the middle of the forty foot span. Floors span between the main beams.

(figure 1)



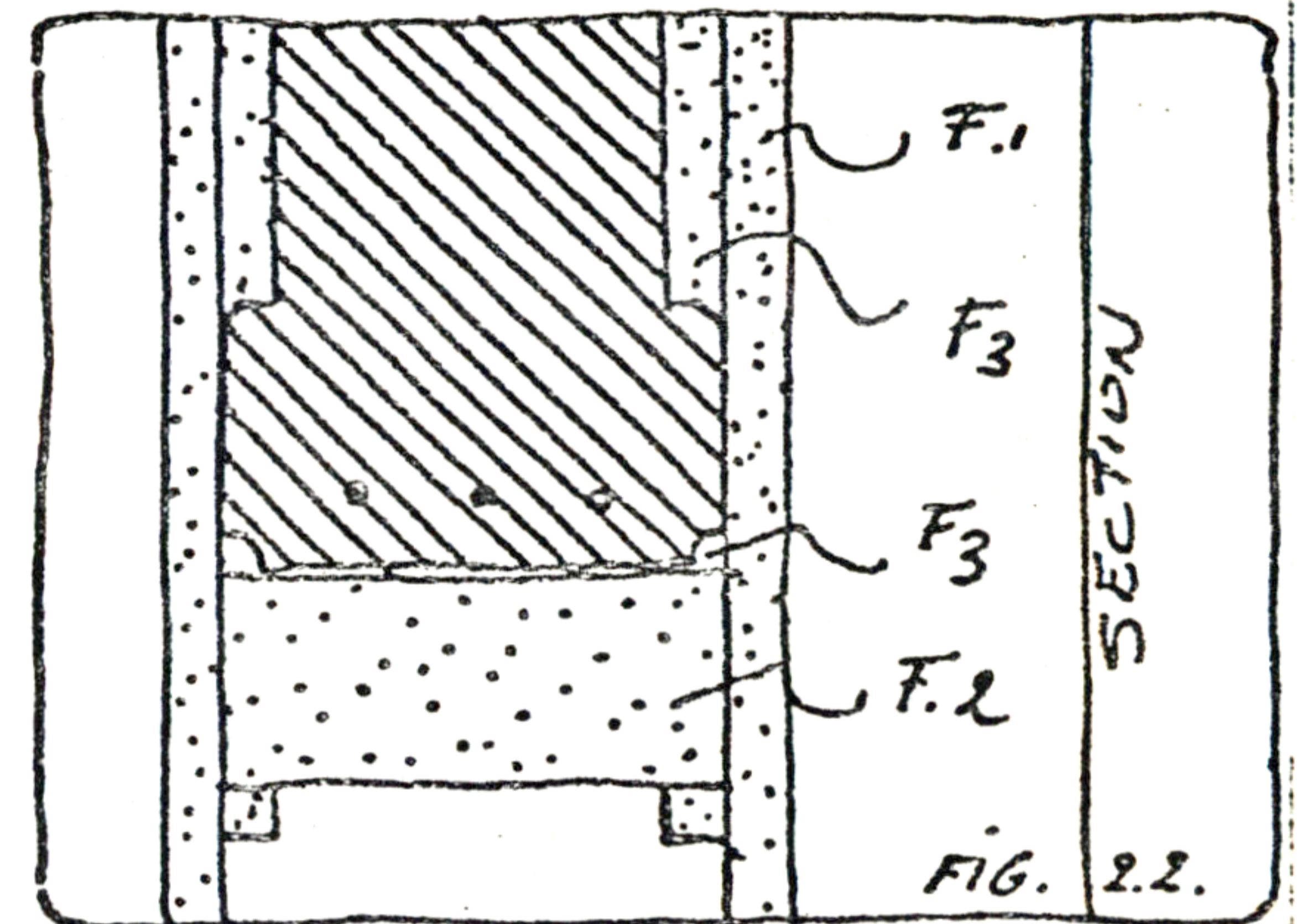
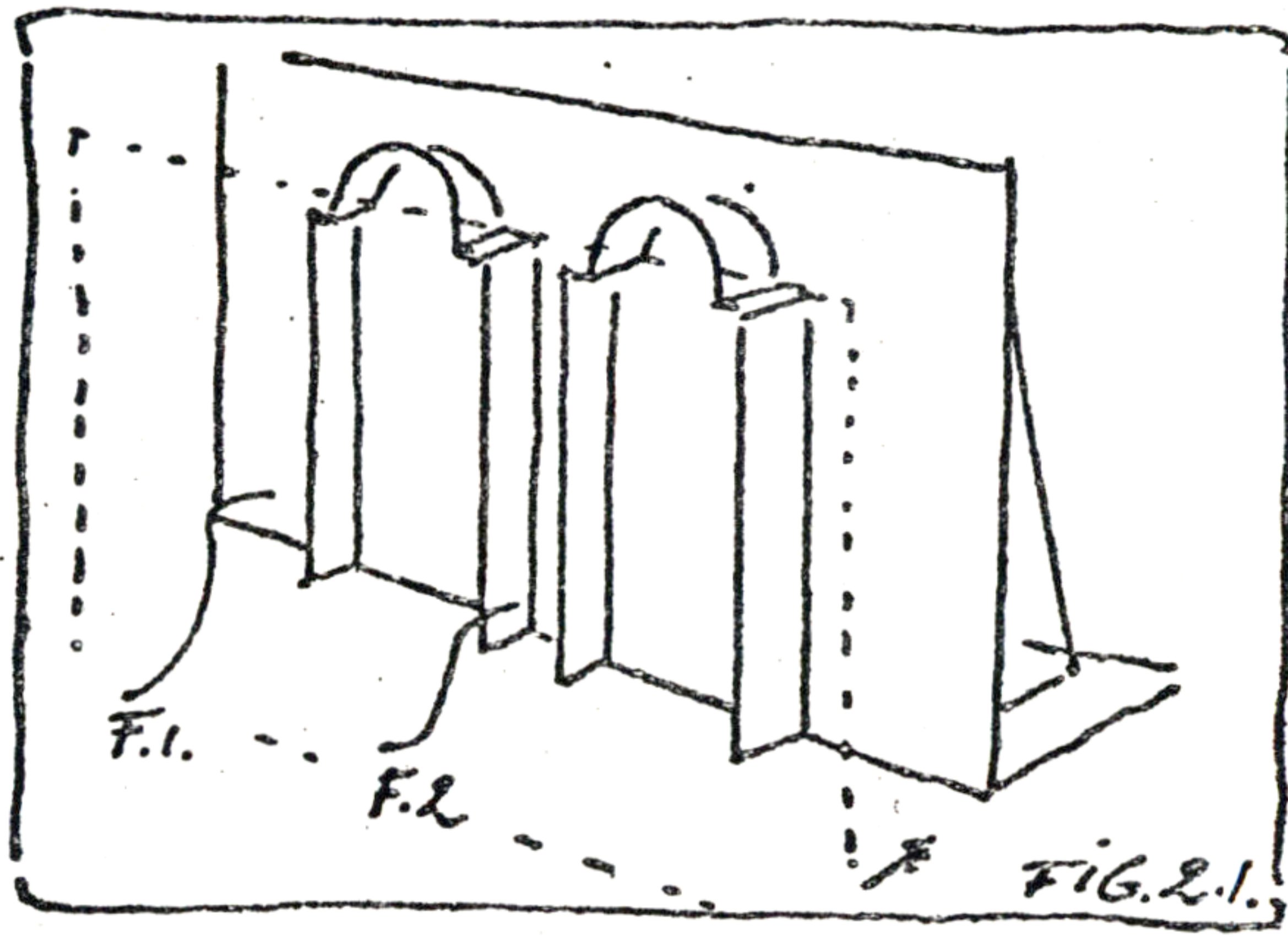
Each building has:

- A. A base of one or two stories
- B. Ceilings and Floors
- C. Upper Structure
- D. Facades and Roof

A. Base

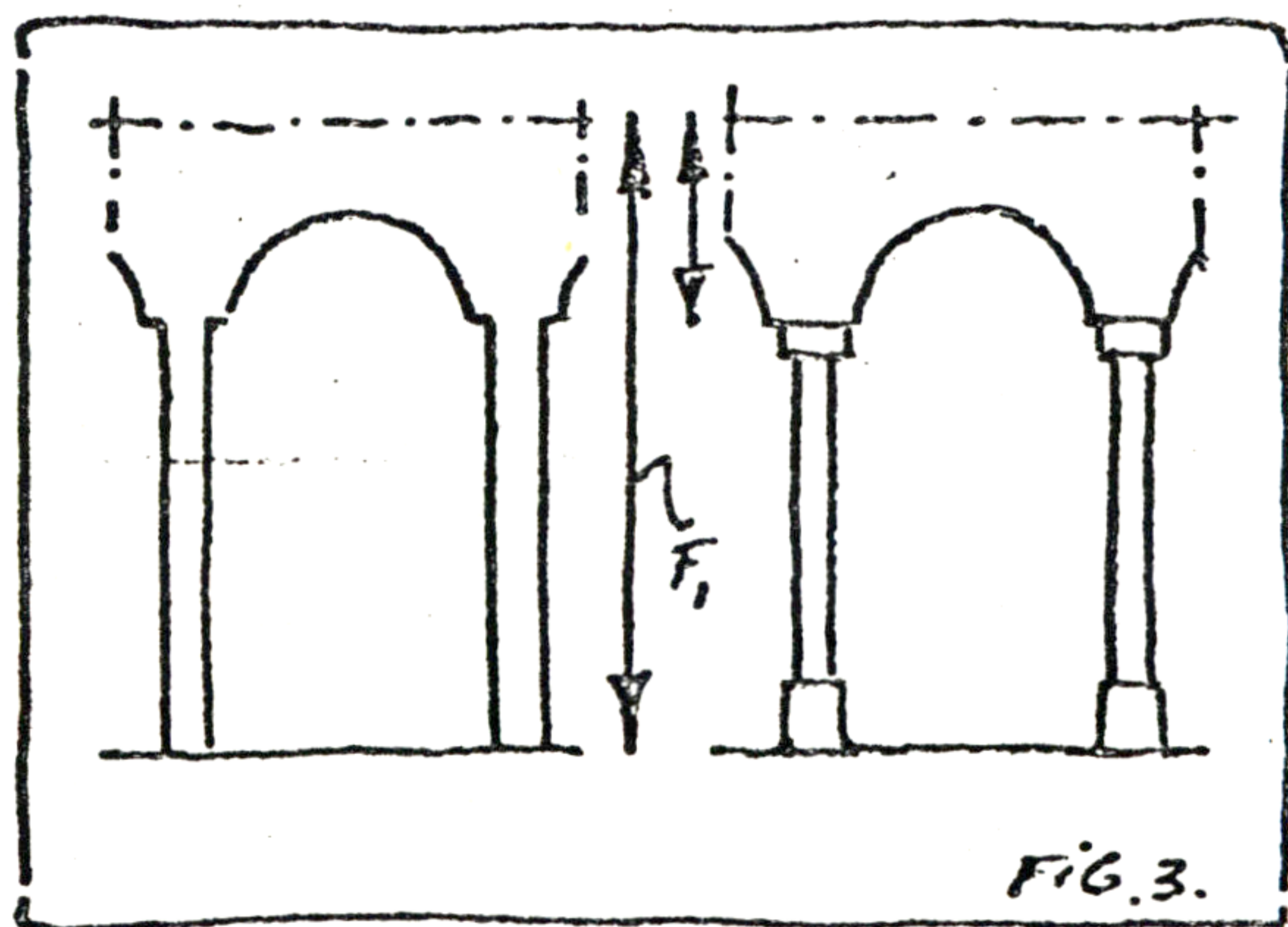
1. Columns, beams, and structural walls are poured in place using a system of "formwork elements". These elements are of three types, each of which is used for a different level of detail:

- a. Vertical plywood plates form thickness and height. F.1
- b. Small tunnels form openings and ends of the elements. F.2
- c. Additional small components form ornament and construction details. F.3 (figure 2.1) (figure 2.2)



2. Special columns (round, polygonal, etc.) are formed in wood or cardboard in three parts.

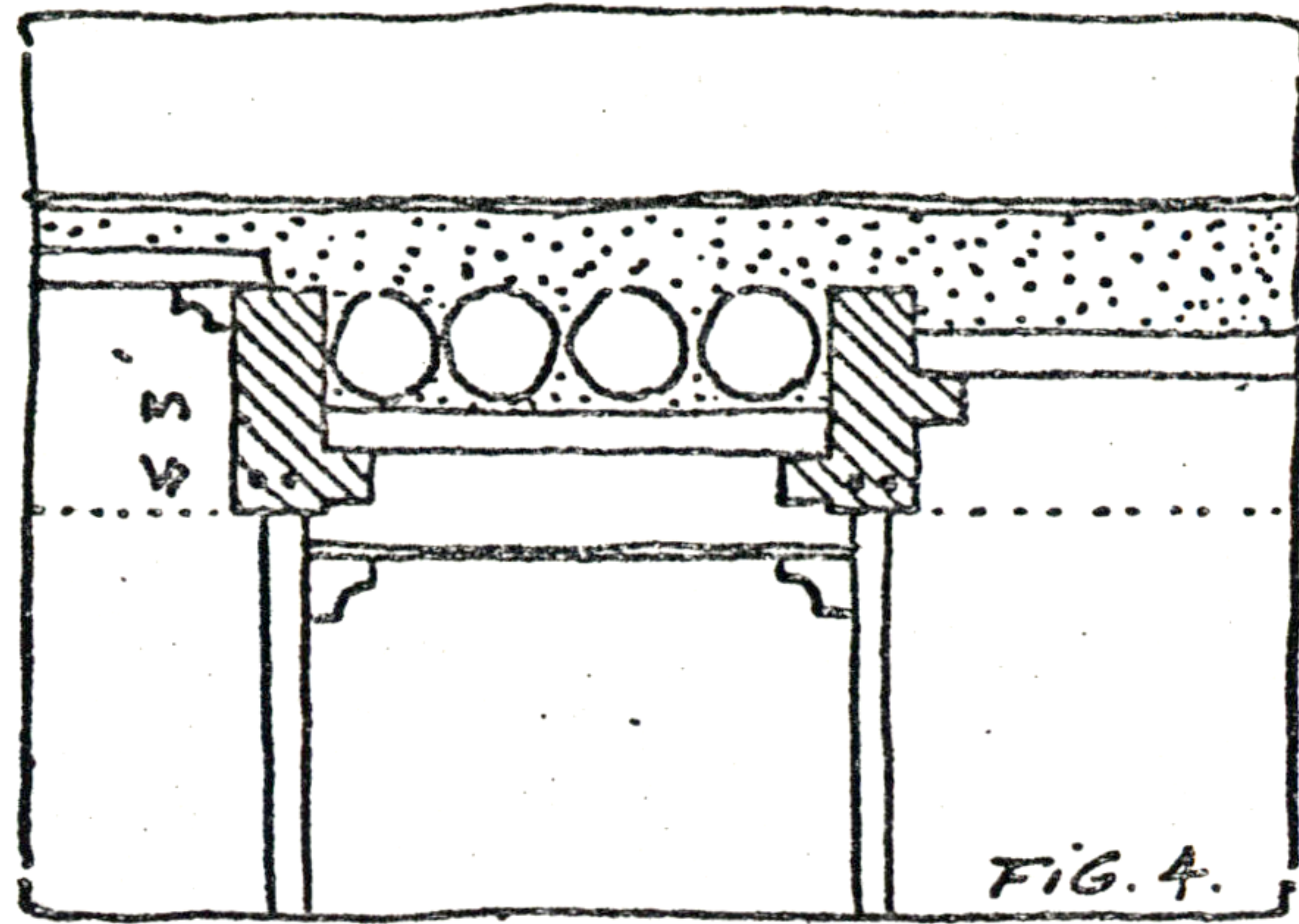
- a. Base-can be prefabricated
- b. Column shaft
- c. Capital-can be prefabricated (figure 3)



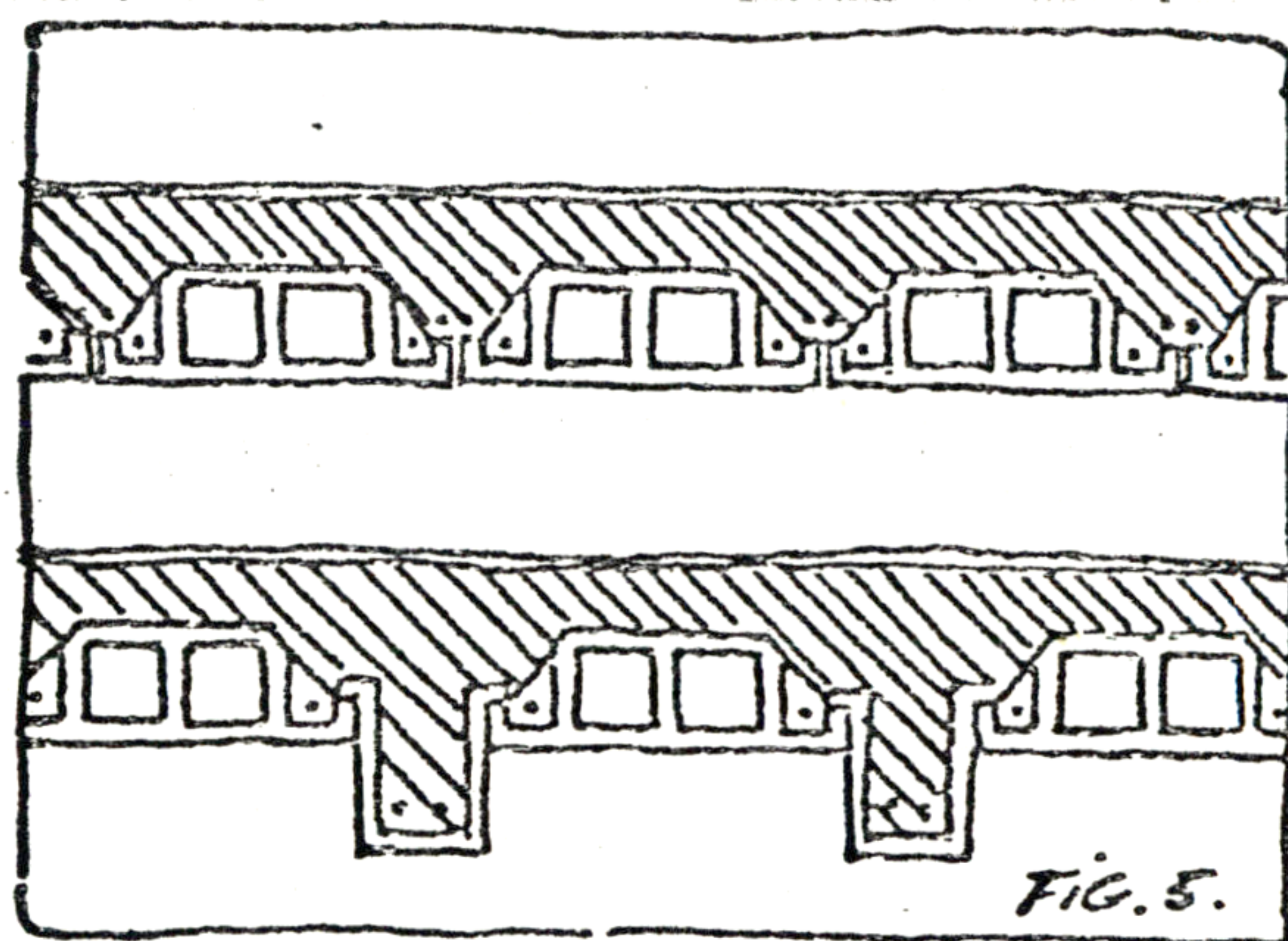
With this type of column, the formwork elements are placed on top of the column capitals to form the next structural element. (e.g. an arch or a beam).

B. Ceiling and Floors

1. Ceiling height variety: The main beams have a maximum depth of three feet. The structural ceiling spans between the beams, and can vary in thickness where necessary to form a flat floor above, by filling with lightweight material. Below the structural ceiling a non-structural one can be constructed where added variety is needed. (figure 4)

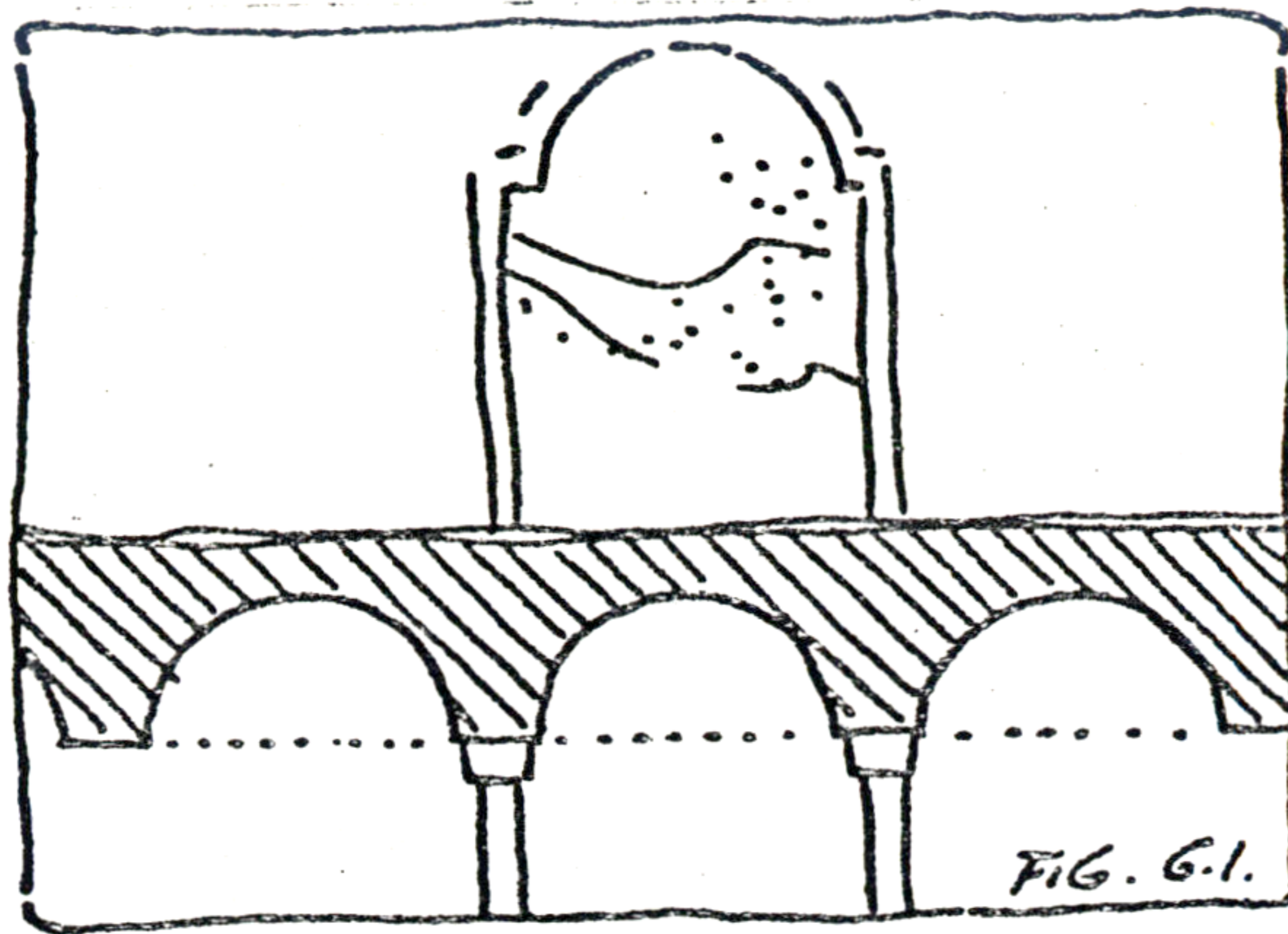


2. Flat Floor: The ceiling -floor structure is built with structural clay tile elements which rest on flanges on the main beams. The floors, made of reinforced concrete are formed by pouring onto these clay tile elements. Additional clay tile pieces can be added to create small concrete beams in between the clay tile elements, where there is a heavier loading or for longer spans. (figure 5)

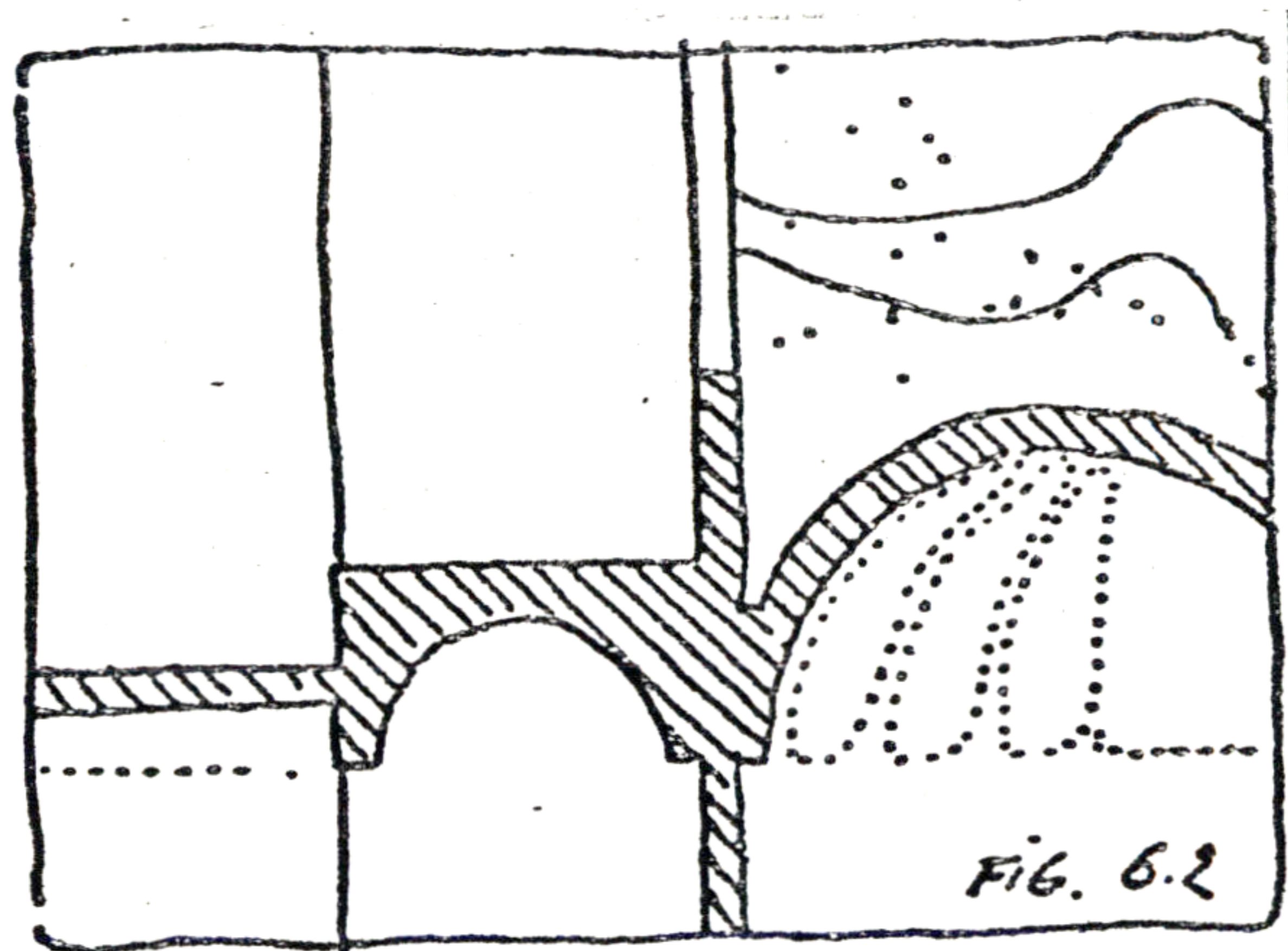


3. Vaults and Domes: There are two kinds, thematic and non-thematic.

a. Thematic: a system of identical vaults or domes is used throughout one floor. (figure 6.1)



b. Non-Thematic: Where vaults or domes cover large spaces, the height of the structure extends beyond the next floor level above, and a higher floor level or an open volume in the building above. (figure 6.2)



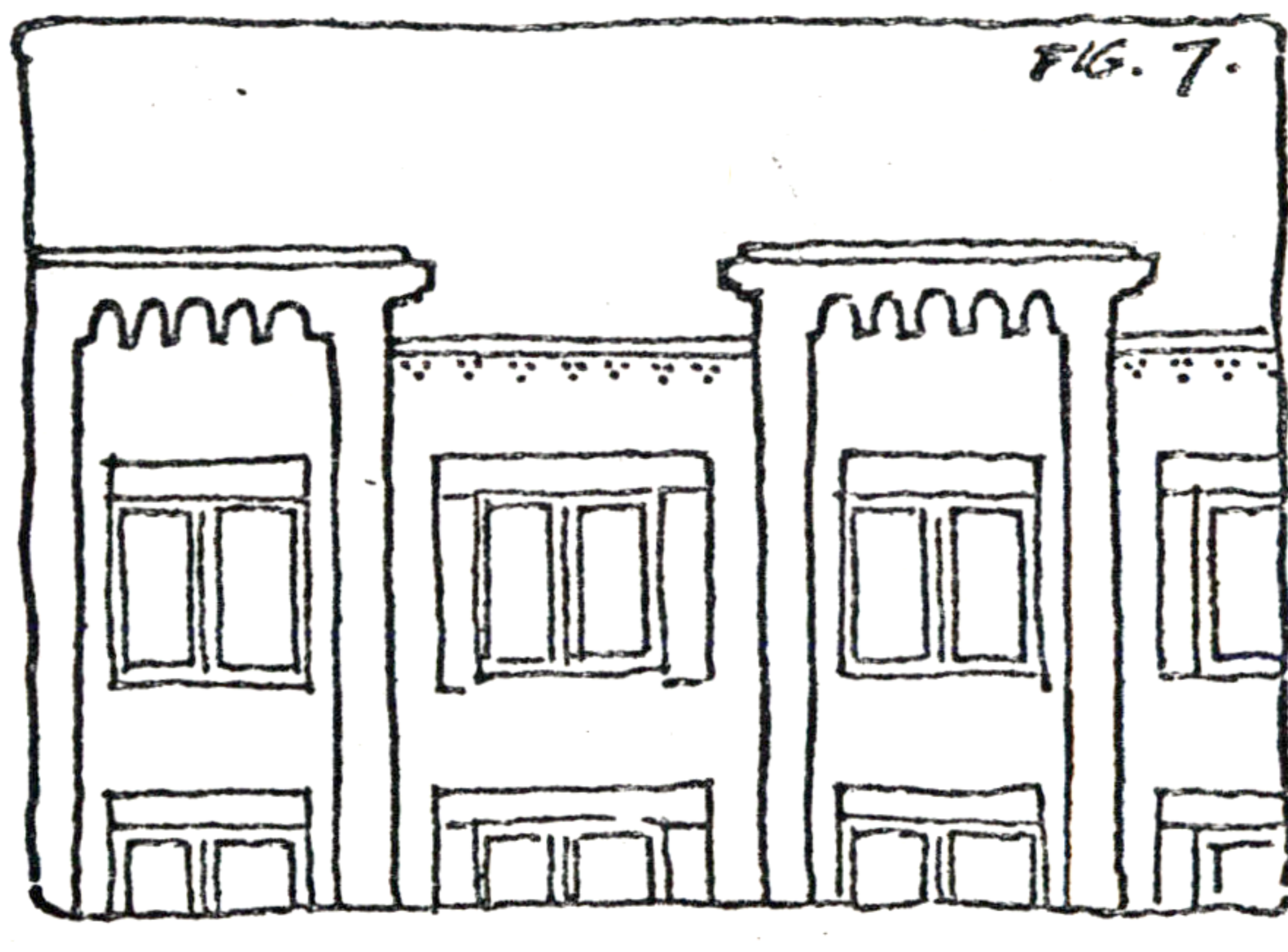
C. Upper Structure

1. The main beams are formed the same way as in the base.
2. The interior columns are formed with concrete blocks reinforced with concrete. Where extra vertical support is needed, columns can be reinforced concrete formed in the manner described in the base.

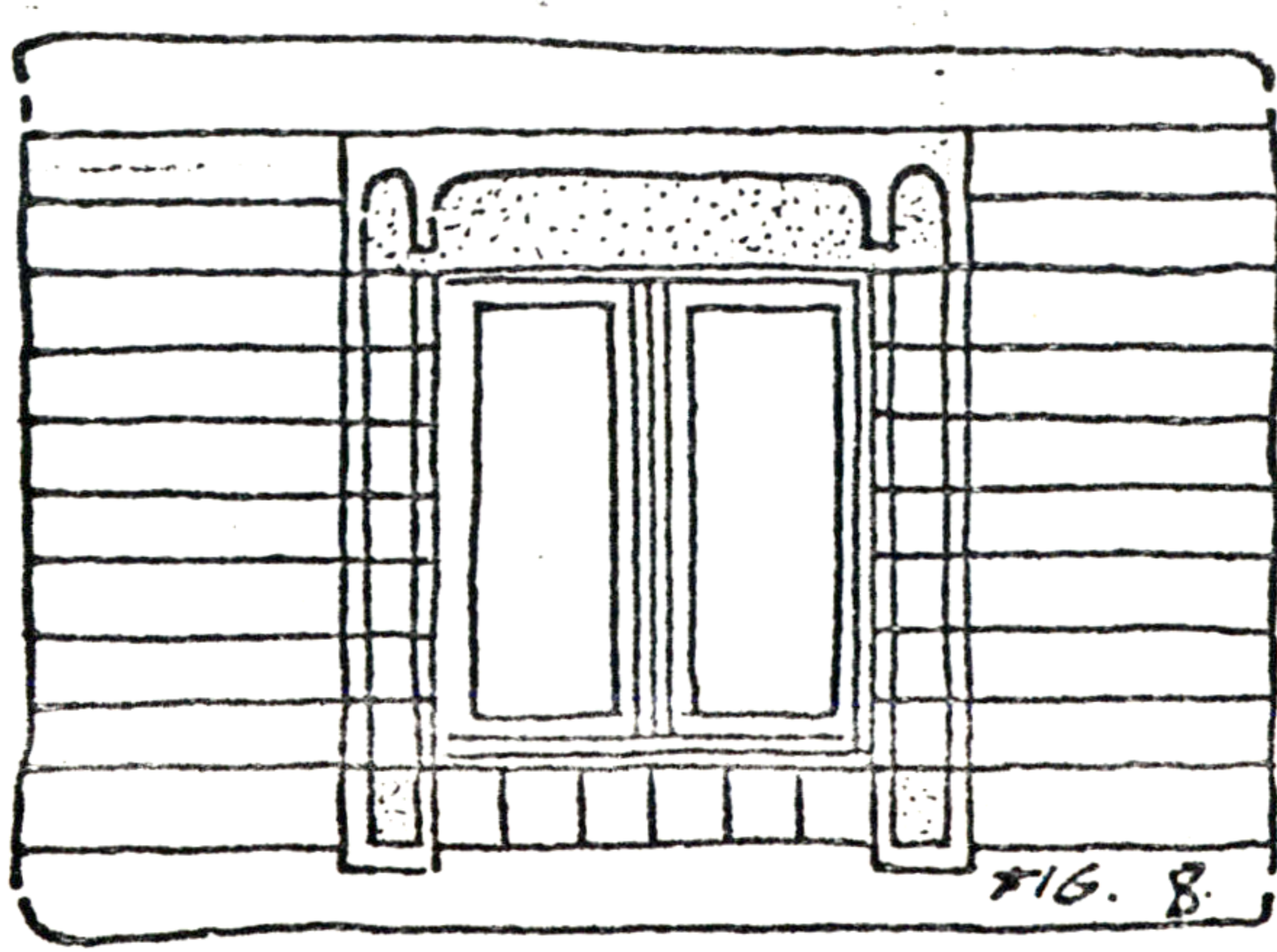
- a. The overall wall thickness is determined by typical wall construction or standard block size.
- b. The openings are defined by the thickening needed to transfer the vertical load above the window to the walls surrounding it.
- c. Ornament is provided by different block types, uses, or patterns, or by exposing the concrete stiffening members around the window.

D. Facades and Roof

1. The Base of the Building: On the facade, the bottom story or bottom two stories have the character of a solid concrete wall with relief and openings.
2. Upper Structure: This part of the facade has the character of a concrete structure with block infill.
3. Vertical and Horizontal Continuity: The facade is given form by the main vertical and horizontal structural elements and by thickening of materials.
4. The Roof: The roof is primarily flat. At the roof, the facade interlocks with the sky in two ways:
 - a. Through the shape of the facade (seen from a distance)
 - b. Through ornament (seen in proximity). (figure 7)

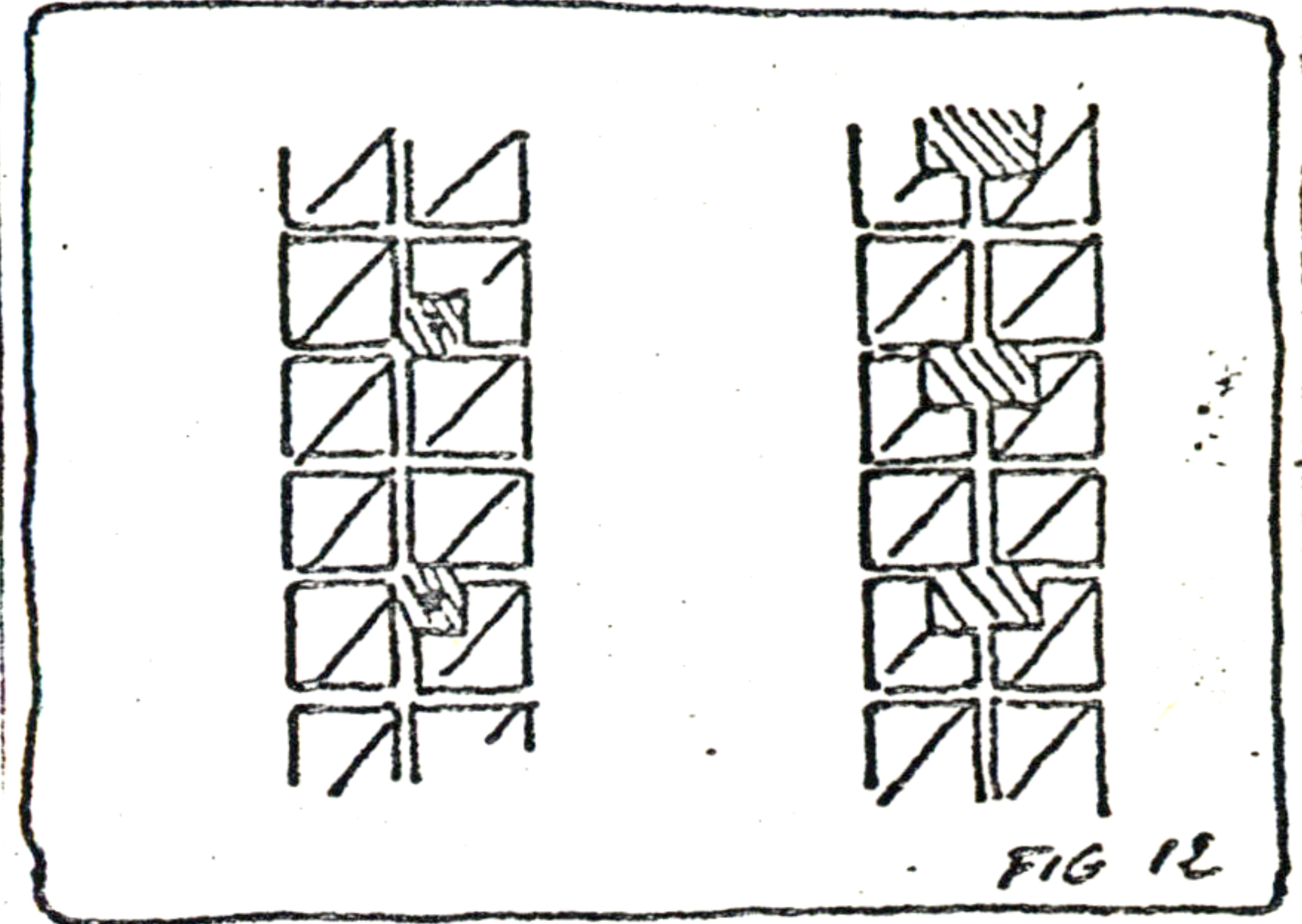
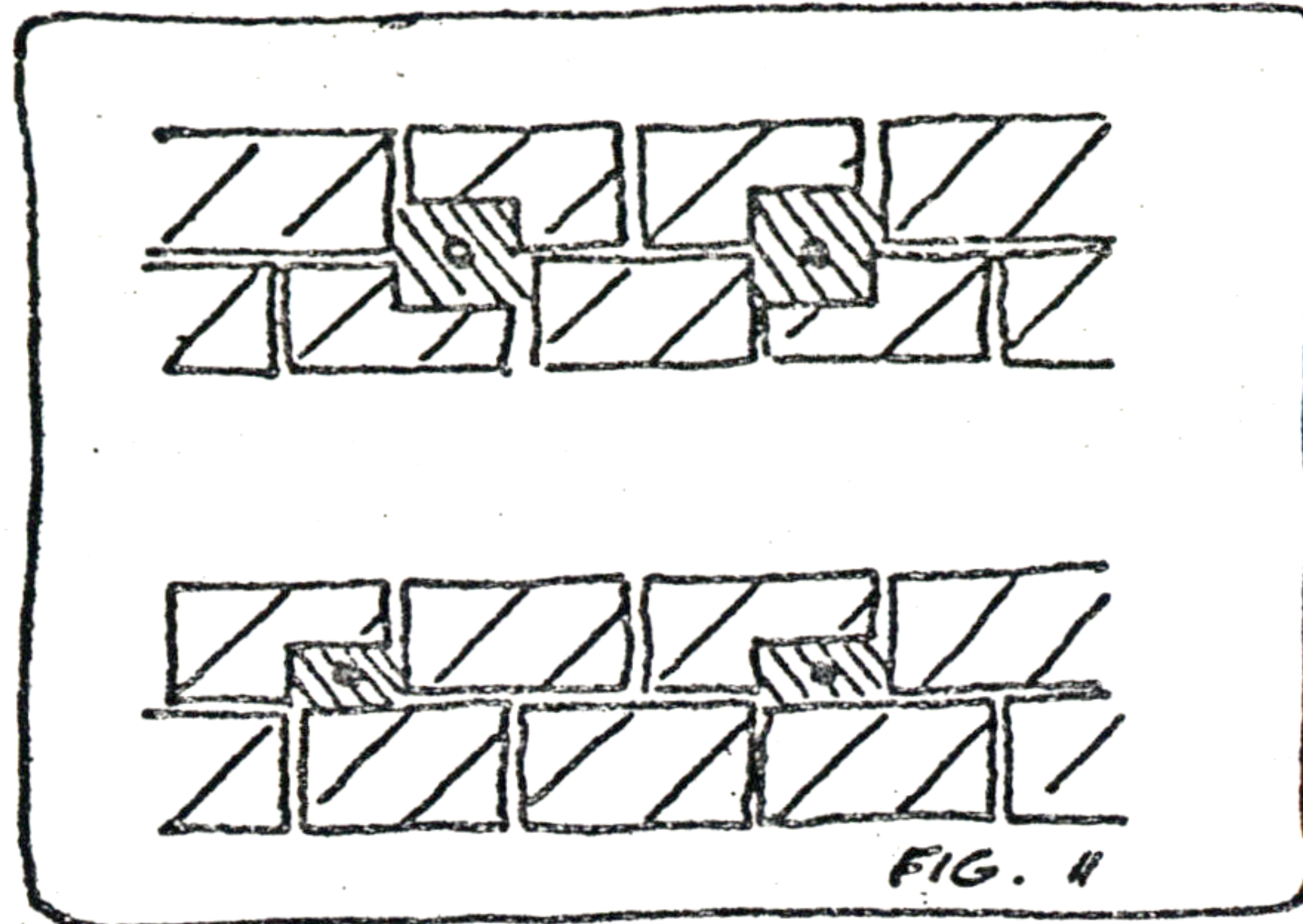


5. Openings: All openings in the facade have thickened edges where materials join. All windows have frames. (figure 8)

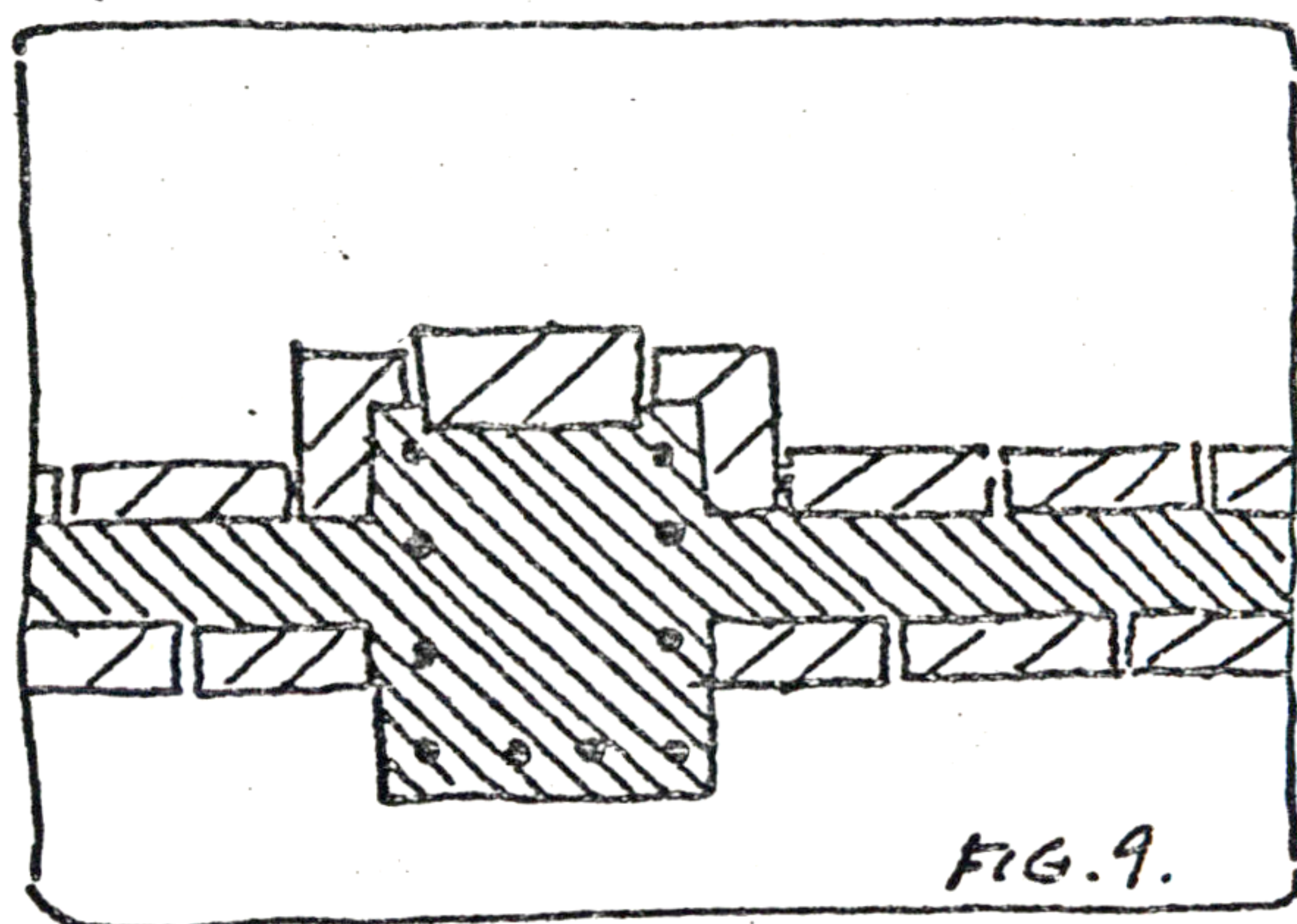


walls, beams, and columns.

a. The walls provide horizontal and vertical stiffening and are themselves reinforced with an integral concrete substructure, poured in continuous voids created by the positioning of the concrete blocks. (figure 11) (figure 12)



b. The columns provide the major vertical stiffening and are formed on 2-3 sides by the concrete block walls and by temporary formwork on the remaining sides. Horizontal stiffening members in the walls connect directly into the columns. (figure 9)



c. The beams provide the major horizontal stiffening and are formed much like bond beams. Where required, beams can be formed as in the base. The vertical stiffening members in the wall connect directly with the beams. (figure 10)

